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ABSTRACT

This proceedings provides the text of 17 conference presentations on access to technology for persons with disabilities. Titles and authors include: "There Is Funding Out There" (Anna C. Hofmann); "Assessment and Prescription for Adaptive Driving Controls" (Michael K. Shipp); "Technology Transfer for the Community Dwelling Older Adults" (M. Cherie Clark); "Research Focusing on Freedom of Choice, Communication, and Independence Using Eyegaze and Speech Recognition Assistive Technology" (Carrie Brown); "The Process of Integrating Software into the Special Education Curriculum" (Dave Edyburn); "Telecommunications Technology in the Future: Its Benefits and Applications to Persons with Disabilities" (Darrell Lauer); "The Arkansas Special Education Resource Center Presents Software Soup" (Kathy Balkman and others); "Three Approaches to the Use of Speech for People Who Are Visually-Impaired" (Fred Gissoni); "Augmentative Communication Alternatives for Persons with Disabilities" (Linda Crawley, Nancy Dunn); "Are You Listening? Developing A Consumer-Responsive System" (Rachell Wobschall); "NASA and the Process of Technology Transfer: Current Involvement and Implications for the Future" (Ismail Akbay); "Technology for Disabled Students in Higher Education" (Riqua R. Serebreni); "The Arkansas Technology Program" (Alan VanBiervliet and others); "Issues in Amplification and Listening Devices" (Hope Keiser); "The Role of RESNA in the Provision of Technical Assistance and Information in Response to P.L. 100-407" (Patricia Beattie); "User Friendly Homes for Today and Tomorrow" (Beulah Hirschlein); and "Trends of Telecommunication for Deaf People" (Al Sonnenstrahl). (JDD)

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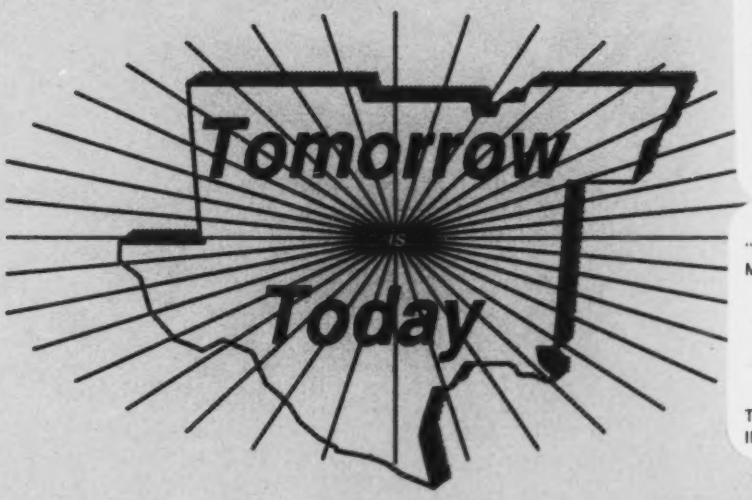

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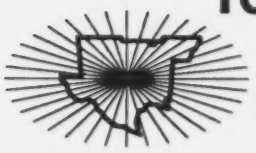

Tomorrow Is Today

Co-Chairs and Editors

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Think People.....Think Technology

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There Is Funding Out There!

Anna C. Hofmann
Phonic Ear, Inc.

*There is funding out there h*as been my slogan since 1981 and I see it as having more believability today than ever before. It was pretty dismal in the early 80's - but I think we can give some credit to then President Reagan for bringing visability to the issues for persons with physical impairments.

Let me give you a chronology of what has happened in this decade due to the efforts of advocates for persons with physical impairments.

If you recall, 1981 was designated as the International Year of the Disabled Persons (IYDP). I look at that program as the kick-off for international awareness of the physically impaired. President Reagan endorsed this program. The U.S. Council in Washington created the Corporate Partnership Program and enlisted the interest, cooperation, and participation of over 200 major corporations in the U.S. in developing programs for the physically impaired. These major corporations were motivated through the IYPD Program to an awareness of persons with handicaps to train, provide equipment, access, etc. so the disabled could get hands-on training and assistance. By November 28, 1983, a ceremony was held at the White House to mark the beginning of the National Decade of Disabled Persons, 1983 - 1992 by President Reagan. Thus, the recognition of need for persons with physical impairments would have continuity with the support of the government and private industry and others with interest in people with handicapping conditions.

Back in the summer of 1980, the Senate Committee on Labor and Human Resources requested that the Office of Technology Assessment (OTA) conduct a study of the technologies for individuals with handicapping conditions. To support its broad responsibilities in the area of disabilities, the Senate Committee asked OTA to take a comprehensive look at the role played by technology in that area.

By May 1982, copies of the full report, *Technology and Handicapped People* were distributed to the Senate Committee on Labor and Human Resources and the President's Committee for Employment of the Handicapped. As a result of this report, a joint hearing of both the Senate and House occurred in Washington in late September. At that joint hearing, papers were presented by manufacturers, professionals and persons with handicaps. Representatives of the augmentative communication industry included Telesensory Systems, Phonic Ear and Prentke Romich.

Telesensory Systems cited as major weaknesses:

- Drastic state-to-state variations in technology diffusion policies where some states will fund communication aids for rehabilitation and others will not, thus almost forcing a person with a handicap to move to obtain needed rehabilitation technology.
- Excessive bureaucracy and overhead in the delivery system where unclear policies and procedures result in excessive delays and barriers, discouraging all but the most persistent.
- Gaps in the system which leave out segments of the population with handicaps for no logical reason. Some communication aids are not covered by Medicare and Medicaid because they are not considered "medically necessary", there is little or no hope for large segments of the handicapped population to obtain funding for an aid.

Phonic Ear, Inc. pointed out that:

- Successful use of technology by persons with handicaps can only be achieved through personal use of a device on a full-time basis. Instead, in the case of child with a disability attending school, the child is exposed to just a few hours each day in the classroom to advanced technology devices; school equipment generally cannot leave the premises, so the equipment is not available for 24 hour personal use.
- Today most families having a child or young adult with a disability have already faced enormous expenditures for diagnostic work-ups and professional help, thus making it impossible for them to purchase a sensory aid for personal use by a family member who has a disability.

Prentke Romich spoke of:

- A need for a comprehensive and equitable funding system, one that serves everyone and does not have to depend on "bake sales and bingo"; a system with priorities that bear some resemblance to human need.
- Directives to Medicare/Medicaid reimbursers supporting the "coverage" of personal use sensory aids as prosthetic devices for individuals with severe and profound losses.

Following the hearing, technology exhibits by manufacturers enabled the members of both the Senate and House, and their staff members as well, to have a hands-on experience with what technology was available for persons with handicapping conditions.

From that report, a number of case studies were prepared. One that is of especial interest to us is Case Study 26, *Assistive Devices for Severe Speech Impairment*, which was

released in December 1983. This case study was about the revolution in communication aids that has since changed the outlook for the non-speaking population, its accomplishments to date, its promise for the future, and its problems. It also related to the policy and the barriers to fully utilize the technology available for the benefits of the population with speech impairments, their friends and families, and society as a whole.

Then in July 1984, OTA released another report titled *Medical Technology and the Costs of the Medicare Program*. This report was requested by the Subcommittee on Health and the Environment in the House and the Subcommittee on Health in the Senate. This report explored the dual relationship between medical technology and the Medicare program.

By this time it became apparent that the interest in technology and the handicapped was not limited to one segment of our federal legislators, but now we see both the Senate and House participating in the exploration of the needs of the persons with handicaps.

At the same time, the National Institute of Handicapped Research (NIHR), already established in 1978, invited business and professionals concerned with people having physical limitations to help them develop and implement a long-range research plan based on realistic needs, major concerns and significant problems currently being experienced by persons with handicaps in the U.S.

Other agencies also entered into programs for individuals with handicapping conditions, i.e., the Department of Education (DOE), the National Institute on Disability and Rehabilitation Research (NIDRR) to name a few.

Meanwhile, State legislators, as well as local agencies, began to investigate programs for the special needs in their states. Early in 1986, California passed a bill providing "Low Incidence Funding", that is, special funding to meet the needs of students with handicaps who require special equipment to pursue their education. Through this program, students would have full-time use of equipment until they left the school system.

In October 1986, the Governor of Minnesota announced the formation of an Issues Team to investigate the potential of high tech to improve the quality of life for Minnesotans with disabilities. By June 1987, he approved the recommendations made by the Issues Team and Minnesota now has an active state-wide program to serve persons with handicaps.

The Pennsylvania Bureau of Special Education in 1985 announced a program to fund long-term loans of assistive devices for use with handicapped students. The purpose of that program was to obtain appropriate high tech equipment for those students with severe handicaps who require such assistance to meet educational goals. The funding for the program came from PL 94-142 monies . . . . and it is still on-going.

For a time the activity at the federal level seemed to be on a plateau until the Congressional election in 1986. With a Democratic Congress, Senator Tom Harkin, D-Iowa,

became the Chairman of the Senate Subcommittee on the Handicapped. By June 1987, he issued a public statement that while he had a personal interest of his own in the handicapped:

> *I want to spend a lot of time just hearing from people in the field and in the handicapped community and what they feel are priority items.*

By May 1988, there was a hearing in Washington where parents of handicapped family members were asked to attend as well as professionals and selected others. It was June 23rd, and Harkin introduced the *Technology-Related Assistance for Persons with Disabilities Act of 1988*, and on August 19th, President Reagan signed the bill into law. With the April 12, 1989, publication of the proposed regulations for P.L. 100-407, governors of participating states began naming lead agencies, committees and readying their states to compete for the new technology dollars, $5 million, to be divided among nine states which received funding the first year of this program. The states selected included Arkansas, Colorado, Illinois, Kentucky, Maine, Maryland, Minnesota, Nebraska, and Utah.

One week later on May 18, 1989, Senator Harkin introduced, along with both Democratic and Republican Senators, the *Americans with Disabilities Act of 1989* (ADA). Harkin calls this the "Emancipation Act for the Handicapped". Right now the bill is in Committee in the House, but Harkin is confident that it will be passed and signed into law by President Bush before the end of 1989. Meanwhile, Harkin asks that:

> *We've got to keep the heat on. Please continue to let your elected officials know about your experiences as a disabled person or the experiences of your relatives, friends, and neighbors who have a disability.*

My reasons for this review are to point out that we are not starting from ground zero in our efforts to get better funding. There has been a slow evolution in the activity at both the federal and state level and it is up to us to keep it alive and make it grow. We cannot do it alone--we need the help of people with disabilities and all those associated with them.

Now let's look at the funding sources. First, let's look at Medicare, Medicaid, and insurance companies. I put them together because all look to one another for payment policy--they all have the same basic requirements.

This chart also illustrates that when you prepared your application, it is not necessary to create a new file of supportive documentation for each one. Their basic requirements are the same; thus, one good application can be used for all three. Having done so, this same information can be used for other sources; in some cases, you may have to work some minor modifications to fit the source.

MEDICARE	MEDICAID	INSURANCE
Durable Medical Equipment (HCFA)	**Medicaid**	**Medical Items Must Pass 3 Steps**
Primarily and customarily used to serve a medical purpose	Primarily and customarily used to serve a medical purpose	Must be prescribed by a physician, i.e., licensed practitioner
Generally not useful to a person in the absence of illness or injury	Generally not useful to a person in the absence of a *Disease*, illness or injury	Condition of patient must be result of illness or accident
Can withstand repeated use	Capable of withstanding repeated use (Durable) and is non-expendable (i.e., hospital bed, oxygen equipment, wheelchair, walker, etc.	Condition of patient must be result of illness or accident
Appropriate for use in the home		Must be one of the covered charges of the policy

Medicare. Augmentative communication devices are defined as Durable Medical Equipment and must be proven as "medically necessary" for the patient.

Medicaid. This is a tough one because each state makes its own interpretation of the law. Here, too, the device must be shown to be "medically necessary" and/or "restore the patient to his best functional level".

Insurance. The key here is "terms of the policy". Coverage by any insurance company does NOT set a precedent . . . . every application stands on its own based on the "terms of the policy".

Vocational Rehabilitation, State & Local Agencies. This group is regulated by local laws and budget constraints.

Private Funding. Is a variable but there have been cases where the Kiwanis, Rotary, Lions, Sertoma, etc. and private foundations have come forward with funds. In fact, there has been considerable interest by some of them to use the "loan bank" approach. The Elks, for example, have a state-wide loan bank in Alaska. UCP in Idaho and Minnesota have set up loan banks in their respective states. And there are probably many others.

Now that we know there are funding sources out there, the question is *how do we get it?* The first thing we have to do is get organized.

For two days following the 1982 OTA hearing referred to earlier, there was a forum discussion of the OTA report. It was there a list was put together that identified barriers for persons with handicaps. I say they are barriers only because people with handicaps *allow* them to be barriers. See the outline of these barriers . . . . see especially the last one and its sub-titles. My experience has been that *ineffective presentation of data* is the major fault.

Limited Employment Opportunities

Lack of emphasis on best skills

Lack of job openings

Increased competition

Lack of Organization Within Disabled Community

Apathy of the community of persons with handicaps

Lack of alliance with Aging lobbies or VA who are very effective

Persons with handicaps not in the "inner circle", the "ole boy network"

Unrecognized commonality of interests

Internal competition

Political Apathy

Persons with handicaps under-registered voters

Under participation in politics

Competition for tax benefits

Source: *Capitol Conference on Technology & Handicapped People.* Washington, D.C., October, 1982.

The first step in your search for funding should be a "check list" (see Exhibit A). Exclude medical information--record only that information that pertains to potential funding sources for your client. This not only lists what sources the patient has used, but also other possibilities.

Next, what information should you include with the application?

- A physician's prescription;
- Professional evaluations: SP, PT or anyone else connected with the patient treatment;
- School teacher, if one, who can attest to the benefits of restoring patient to best functional level;
- Statement from a family member or even the patient him/herself;
- Descriptive literature of the device you are seeking;
- And, if you get a denial, then ask for a hearing and if possible, take your patient with the device to the hearing.

All these supportive documents should be written with these key words in mind:

Proof of: *Medically necessary*, and/or
Restore patient to his best functional level

Here are some suggested Do's and Don'ts when preparing the application.

DO'S

It should be demonstrated to show that cerebral palsy or similar disabilities are medical problems and the use of a speech prostheses would have therapeutic effect on the patient by reducing emotional and psychological frustrations. From this perspective, it can be shown that acquisition of a speech prosthesis involves the issue of medical care.

It should be demonstrated that speech prosthesis can be a motivational factor to increase the ability to communicate with others. With such increased functional use of the device, there can be perceptive lessening of release of anger and emotional frustration.

If you think the client is employable, then demonstrate how a speech prostheses will help him/her gain employment . This is especially effective if you are working through the Department of Vocational Rehabilitation.

Keep in mind that cost is *always* a factor. Include in the application a brief description of *all* the augmentative communication devices the client was tested for. Include the pros and cons of each device, price, and then state why the device was chosen. This then answers the possibility of denial because of the cost factor.

DON'TS

Do *not* assume that because Medicare, Medicaid or the insurance companies approved a device in your state, that all applications following will be approved . . . there is no such thing as "precedent setting".

Do *not* label the item as an education device, because Medicare, Medicaid or the insurance companies will not cover for that reason.

Never describe it as a communication tool or aid because they may say that it is not essential to improve the patient's *medical condition* as required by law.

> *Never* give the impression that the item will be a convenience item . . . . the examining officer will tell you that alternatives are available at much less cost.

In closing, let me quote from an editorial that appeared in the magazine, *Exceptional Parent* titled "The Future is Here":

> *In this field, we have learned that the willingness to accept things as they are is a major barrier to change.*
>
> *As technological advances have helped to raise the quality of education and community life, disabled people of all ages have come to demonstrate far greater capabilities than were thought possible in the past. We know that knowledge is the first step toward concrete action. Let us acquaint ourselves with the miracles technology can accomplish, and then work together to make these miracles available to all.*

Resources

Chronicle of Philanthropy
1255 23rd Street, NW
Washington, D.C. 20037
$47.50 1 year (24 issues)
$24.00 6 mos. (12 issues)
November 1988

The Foundation Center
79 Fifth Avenue
New York, NY 10001
212-620-4230
See local library
*June 1988

Grants for Physically and Mentally Disabled
The Foundation Center
79 Fifth Avenue
New York, NY 10001
$38.00 + $2 shipping/handling
*June 1988

Funding and Reimbursement for Assistive Technology 1988
(Hearing in Washington, DC)
ASHA
10801 Rockville Pike
Rockville, MD 20852
301-897-5700

Self-Sufficiency Trust of Illinois
340 W. Butterfield Rd.
Suite 3C
Elmhurst, IL 60126
312-941-3498
October 1988

Electronics Industry ASSN/Rehab Engineering Center (EIA/REC)
1901 Pennsylvania Avenue, NW
Suite 700 - Attn: Library
Washington, DC 20006
202-955-5826

Enhanced Consumerism within Commercial Rehab Product Markets: A goal for Independent Living, January 1986

Final Report of the National Task Force on Third Party Payment for Rehab Equipment, February 1987

Revolving Loan Funds: Expanding Equipment Credit Financing Opportunities for Persons with Disabilities, June 1987

Private Insurance Reimbursement for Rehabilitation Equipment

(All the above written by: Ken Reeb, Jr.)
(No Charge.)

An Overview of Medicaid Payment for Rehab Equipment, Reeb & Markowicz
*September 1988

Assistive Financing for Assistive Devices: Loan Guarantees for Purchase of Products by Persons with Disabilities, January 1989 Ken Reeb

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National Institute of Handicapped Research
Office of Special Education & Rehabilitation Services
U.S. Department of Education
Write: Government Printing Office
Washington, D.C. 20402
*January 1987

Financing Options for Home Care for Children with Chronic Illness and Severe Disability
Technical Assistance Manual
Human Services Research Institute
2336 Massachusetts Avenue
Cambridge, MA 02140
December 1988 $20.00

The Many Faces of Funding
Phonic Ear Inc.
250 Camino Alto
Mill Valley, CA 94941

Technology and Handicapped People
OTA, May 1982
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Case Study #26, Assistive Devices for Severe Speech Impairment
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Medical Technology and the Costs of the Medicare Program
OTA, July 1984
Supt. of Documents, Washington, D.C.

Assessment and Prescription for Adaptive Driving Controls

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With the development of new technology, more individuals with higher level physical disabilities have a realistic chance of driving. Although type and level of disability are important considerations, driver evaluators are mostly concerned with the functional abilities of the individual as they relate to the driving task.

Driver Rehabilitation Team

In order to accurately determine the functional abilities of the individual, an integrated team approach is essential. The driver evaluation team should consist of an occupational therapist, driver evaluator/educator, physician, and rehabilitation engineer. In addition, a vision specialist, neuropsychologist and medical specialist should be available for consultation.

In addition to the professionals involved directly in the driver assessment, several key persons must be involved in the driver rehabilitation process. These include the family, referral/funding soufce, vehicle modifier, and department of motor vehicles.

Driver Assessment and Education

The driver assessment and education program at Louisiana Tech University is a comprehensive program designed to help meet the personal transportation needs of persons with disabilities. Following are brief descriptions of the components of the program.

Vision Screening

Vision testing equipment is used to screen the person's:

-visual acuity	-color vision
-field of vision	-night vision
-depth perception	-glare vision
-phoria	-glare recovery

Hearing Screening

An audiometer is used to provide gross measurement of the client's effective range of hearing. The client may be referred to a specialist if significant deficits are noted.

Reaction Time Measurement

A computerized search and reaction test measures simple and complex reaction time. Also, reaction and react time involving the upper extremities is measured with the aid of the

"Available Motions Inventory" assessment system. Where appropriate, lower extremity reaction time is measured using a brake/accelerator pedal reaction timer.

Cognitive Testing

The *Motor Free Visual Perception Test* and the *Baylor Adult Visual Perception Test* are used as a screening for visual-perceptual ability.

Driver Performance Test (DPT)

The DPT is a videotape presentation of driving situations selected to determine a driver's ability to perform the visual-perceptual and decision-making tasks required for operation of a motor vehicle safely in the highway transportation system. The client is asked to choose from multiple choice responses after viewing traffic scenes. Test results give the evaluator information regarding the client's ability to Search, Identify, Predict, Decide and Execute in the highway transportation system. Test scores have a high correlation to the potential traffic accident involvement of the driver.

Driver Risk Index (DRI)

The DRI is a videotape test designed to determine the risk taking characteristics of a motor vehicle driver. The traffic scenes and driver comments apply to the following driving risk categories: Passing; Yielding; Following; Speed control; and Environmental.

Safe Performance on Road Test (SPORT)

SPORT is a test that measures the driver's onroad performance in each of the following operational skills: Observing; Communicating; Speed Adjustment; Vehicle Positioning; Time and Space Judgement; and Hazard Perception. It does not replace the on-road test, but aids the evaluator in determining potential problem areas.

Ability to Transfer

An evaluation of the potential driver's ability to:

--lock/unlock and open/close the door
--transfer from their wheelchair to the driver's seat
--secure the wheelchair for driving
--remove the wheelchair from the secured position
--transfer from the driver's seat into the wheelchair

Active Range of Motion

The client's active range of motion, which can be described as the movements a client can make without assistance, is measured by an occupational therapist.

Manual Muscle Test

A standard manual muscle test is administered by an occupational therapist to those clients presenting with muscular weakness associated with their disability.

Motion Analysis

The motion analyzer is used to measure the movements a client can make unaided. As the client performs motions necessary for operating adaptive driving controls, the device measures a set of pre-selected points. A graphic representation of these points is produced for the evaluator. These data aid in determining the appropriate type of system for the client.

Functional Strength Analysis

A functional strength analyzer is used to gather data regarding the client's ability to apply force for steering and brake/ accelerator control functions. This device measures the amount of force applied at various steering wheel positions and hand control angles. These data aid in determining the appropriate type of system for the client.

Tracking Simulator

A computer controlled device that measures the ability of a person to perform the basic control motions necessary to drive a motor vehicle. The driver uses adaptive controls to perform a tracing task generated by a computer program. The simulator allows the evaluator to compare the client's ability to operate a variety of adaptive controls.

Small-Scale Vehicle Evaluation

This evaluation is a measure of the person's ability to control a vehicle in a dynamic situation. The vehicle is a modified golf cart equipped with the adaptive driving controls determined to be appropriate by the evaluator. This affords the evaluator the opportunity to observe the client performance in a controlled, non-stressful environment. The client's ability to perform the basic driving maneuvers is objectively measured by observers.

Full-Scale Vehicle Evaluation

The driving candidate operates a full size vehicle in order to determine:

--the appropriateness of the controls used on the small- scale vehicle

--the client's need for power steering and brake backup systems

--the need for and placement of secondary control adaptations

--final determination of adaptive device needs

Adaptive Device Prescription

Based on assessment results, and individualized prescription is written for the client. This includes recommendations for vehicle selection, appropriate adaptive devices and controls

and vehicular modifications. The prescription is written to be cost effective without compromising the safety of the client or other highway users.

On-Road Performance Evaluation

This evaluation is conducted on a standardized assessment route that has been designed to present the client with representative traffic situations. The evaluator rates the client on the following functional skills: Observation; Communication; Speed Adjustment; Vehicle Positioning; Time and Space Judgement; and Hazard Perception. Results of the evaluation are used to aid in determining whether or not the client possesses adequate driving skills. The results also assist the evaluator in creating an instructional plan for the client.

Assessment Results

In most cases, the individual will participate in all phases of the evaluation. Occasionally, the assessment process will be interrupted due to obvious deficits that cause concern for the safety of the client or evaluator.

In the interest of fairness to all concerned, an individual's driving potential is not determined on the basis of one test result. The evaluators consider the results of the complete battery of tests before determining a person's ability to drive.

After completion of the evaluation, one of four results or recommendations will be determined. These include:

1) *Normal Driving Activity* - The client and department of motor vehicles are advised that a resumption of normal driving activity is appropriate.
2) *Driving with Restrictions* - The client has exhibited appropriate driving behavior under restrictive conditions. These may include common restrictions such as:

Contact Lenses	Power Steering
Automatic Transmission	Adaptive Equipment
Daytime Driving Only	Periodic Examination
Left Outside Mirror	Restricted to within a certain distance from home

Special accommodations can also be made for someone to drive only during limited times of day on specified roads. An important key in this area is the establishment of good communication between the evaluation facility and the driver licensing agency.

3) *Further Diagnosis* - In some cases the evaluator will recommend further diagnosis from *other* professionals such as vision specialists,

neuropsychologists, or other medical specialists. If it is found that certain deficits cannot be corrected and will not be likely to improve, the client may be disqualified from driving. In some cases, a re-evaluation will be recommended. These types of cases include those persons who have suffered a stroke or head injury and have not fully recovered biologically. In cases where a seizure history is present, the client may be precluded from driving for a certain period of time. A re-evaluation should be conducted after the physician has certified the person has been seizure-free for the appropriate amount of time.

4) *Disqualification* - After a careful review of the client's history and test results, it may be necessary to recommend that the person not be allowed to operate a motor vehicle. In these situations, the state driver licensing authority and the client's motor vehicle insurance company should be notified as soon as possible. In these cases, the client should be advised to contact the appropriate parties. No person, agency or facility should report such a situation or release any information regarding the assessment without a release statement signed by the client.

Driver Education and Training

The driver education and training program includes three phases of instruction. Classroom, driving range, and behind-the-wheel activities are integrated to provide the clients with the learning experiences that will help make them appropriate users of the highway transportation system. The program is performance based to provide for individual needs.

Classroom

The classroom phase of the program is self-paced and competency based. Students are allowed to complete certain units by demonstrating a minimum competence level on a pre-test, thus getting credit for what they have already learned. Some of the topics included are; Defensive Driving Techniques, Traffic Laws, Emergency Driving Procedures, Other Highway Users, Alcohol and Other Drugs, Buying a Vehicle, Insurance, Vehicle Maintenance and Care, Accident Responsibilities, and Energy Efficient Driving.

Driving Range

These activities are designed to give the client the opportunity to practice and routinize basic vehicle maneuvers, while using the adaptive driving controls best suited to their needs.

Behind-the-Wheel

Behind-the-wheel instruction will vary for each client, depending on his or her ability to acquire the basic skills necessary for safe driving. Clients with previous driving experience generally require less instruction than beginners. After the client has completed all of the driving objectives, an On Road Performance Test is administered. The ORPT is designed to evaluate a driver's responses to representative driving situations. It is a comprehensive test for assessing the driver's ability to make and properly execute good and timely decisions in traffic situation.

Prescription of Adaptive Driving Controls

Before selecting a vehicle or purchasing any adaptive driving equipment, an individual should receive a comprehensive driver evaluation from a certified driver assessment/education facility.

Vehicle Selection

Using the three basis categories of vehicles, following are some considerations for appropriate vehicle selection.

Sedan

In order to drive a sedan, a person must be able to:

- lock/unlock doors
- open/close doors
- transfer independently
- store and retrieve wheelchair

Full-Size Van

If a person is able to use a transfer seat, most of the full-size vans will be acceptable. If the person must drive from a wheelchair however, a Ford E150 van is recommended for the following reasons:

- most space available in driver area to accommodate wheelchair
- floor can be lowered to 4" without cutting the vehicle chassis frame

Other general considerations for van modification include:

- it is generally less expensive to purchase a stripped down van and install carpet, etc. later
- factory installed auxiliary air conditioners may interfere with vehicle modifications and usually should be planned as an add-on item
- auxiliary fuel tanks will have to be removed for floor lowering and power pan installation

Mini-Van

Unfortunately, adaptive driving technology has not caught up with the popularity of mini-vans. There are several limitations of mini-vans that would prevent them from being appropriate vehicles for a disabled driver. Most of these are due to space limitations and include:

- generally not recommended for driving from a wheelchair
- rotary lifts are not available
- usually require a raised roof

For a wheelchair rider who can transfer independently, a mini-van may be an excellent alternative to the full-size van.

Used Vehicles

When considering a used vehicle for modification, several factors must be considered. Any used vehicle should be inspected by a certified mechanic and/or engineer to assure it is suitable for the type of modification recommended. Several state rehabilitation service agencies have established age and mileage guidelines for used vehicle modifications. These range from 2 years/24,000 miles to 5 years/50,000 miles.

Another key consideration is the type of modification being considered. For example, if a recommendation is for installation of mechanical hand controls, an older vehicle may be appropriate if in good mechanical condition. However, if the modification will involve structural modifications, reduced effort steering and/or brakes and the installation of several electrical components, an older vehicle may not be appropriate.

Adaptive Device Prescription

The prescription report should include a complete list of equipment and vehicle modification recommendations. A list of recommended vendors should also be furnished.

It is critical that the client, evaluator and the equipment installer have a clear understanding of the specifications and their role in assessing the successful completion of the modifications.

Following are some examples of adaptive equipment/vehicle modification costs for various levels of disability.

NOTE: These examples are intended for general information purposes only. They are designed to provide a relative idea of equipment needs and cost levels. They should not be assumed to be complete or used for specification of adaptive driving equipment or vehicle modifications. Prices are based on suggested retail lists from several sources, and actual bid prices will most likely be significantly lower.

Sedan

Client is able to independently transfer and store and retrieve the wheelchair in the vehicle.

Push-Right Angle Hand Control w/horn button	$500
Spinner Knob	50
Parking Brake Extension Lever	75
	$625

Van with Transfer Seat

Client is able to transfer independently, but is unable to store and retrieve a wheelchair and/or transfer into a sedan.

Automatic Door Opener	$ 750
Fully Automatic Rotary Lift	2900
6-way Power Seat	1200
Wheelchair Tie-Down (for unattended chair)	200
Push-Right Angle Hand Control w/horn button and dimmer switch	600
Reduced Effort Brakes	700
Brake Backup System	1600
Parking Brake Extension Lever	75
Remote Switches (4)	800
Steering Device	70
	$8,895

Fully Modified Van

Client must drive from his/her wheelchair, and has functional strength and range of motion limitations.

Automatic Door Opener	$ 750
Fully Automatic Lift	2900
Lowered Floor	3000
Automatic Wheelchair Tie-Down	1200
2-point Passive Restraint System	200
4-point Tie-Down for Passenger Position	700
Removable Seat Base w/rearward lockdown position	400
Steering Device	70
Steering Column Extension	500

Reduced Effort Steering	50
Steering Backup System	1600
Servo Brake/Accelerator Control System	4000
Power Gear Selector	600
Remote Switches (4)	800
Secondary Control Console	1500
Power Parking Brake	300
	$19,020

The following sources are suggested for obtaining further information:

Louisiana Tech University
Center for Rehabilitation Science
and Biomedical Engineering
Michael Shipp
Adaptive Driving Program Manager
P. 0. Box 3185
Ruston, LA 71272-0001
(318) 257-4562

Chrysler Motors Physically Challenged
Resource Center
Albert Edwards, 111, Program Manager
P. 0. Box 159
Detroit, Ml 48288-0159
800-255-9877

American Automobile Association
(AAA)
Dr. Francis C. Kenel, Staff Director
8111 Gatehouse Rd.
Falls Church, VA 22047
(703) 222-6341

Veterans Administration

Prosthetic & Sensory Aids Service
Washington, DC 20420
(202) 233-2011

Technology Transfer for the Community Dwelling Older Adult

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Delivering assistive technology into the hands of older users has been difficult, at best. Understanding who are potential older users of assistive technologies, what products are most appropriate for this population and what are the best marketing and sales techniques to use with this group are major issues that have not been systematically addressed. Embedded within these issues are the ubiquitous problems of technology transfer and funding for assistive technology that plague all health services systems. Given the rapidly increasing older population and the projected inability of traditional health care systems (*e.g.*, nursing homes, home care services) to meet the demand created by this large, frail older population, much more attention is being paid to the role assistive technology can play in prevention and intervention in daily living task performance.

Our emphasis at the Technology Center for Independent Living is on the provision of services, products and information regarding assistive technology to enhance daily living for community and institutionalized older persons. Our work has taken a somewhat opposite direction than that of the traditional disability and rehabilitation networks. While the emphasis in these latter groups has increasingly focused on high-tech interventions, as evidenced by many of the presentations at this conference, our work (and others in the field of Gerontology) has been focused on the application of low tech assistive devices for older users who experience normal age-related declines in functional performance.

This direction is primarily dictated by the nature of the population we serve. I want to first describe this population and their needs for assistive technology and then show you some examples of how our Technology Center is directing efforts at marketing and providing assistive technology to older adults.

There is no other age group that can be characterized better by heterogeneity than the elderly. There are very healthy old, old people and very disabled young old people: significant numbers of older people fill every cell in the matrix of age by capability. Moreover, it is the norm, not the exception for aging to be accompanied by multiple disabling conditions (*e.g.*, heart disease and arthritis). This makes the application of technology for older adults a complex and often confusing problem. While we know that there are age-related declines in various capabilities (*e.g.*, grip strength, effective reach height, mobility), and increases in use of homecare services (1), we have little empirical information regarding how these decreases in

function affect performance of daily living tasks. This type of information is critical to the appropriate design and application of assistive technology.

A series of research projects were conducted at the Stein Gerontological Institute to investigate activity of daily living (ADL) performance by healthy older adults living independently in the community (2,3,4). This series of studies applied human factors research techniques to examine ADL performance. This approach assumes that task performance is a function of the match between task demand and person capability. For example, one component involved in cooking a meal is the retrieval of a cooking container (*e.g.*, pan). The cupboard where the pan is located presents a demand, you must be able to open it. You either may or may not have the capability to open the cupboard. Successful performance (*i.e.*, retrieval of pan) is determined jointly by the match of your capability and the task demand. This analysis was applied to 24 different ADL's (*e.g.*, cooking, housecleaning, grocery shopping, etc.). Table 1 presents data from the questionnaire phase of this research project highlighting problems with ADL performance reported by 244 older adults. The striking feature of these data is the high percentage of *well* elderly reporting difficulty with daily tasks. This is clearly a group who could benefit from technologies designed to assist with daily living tasks.

Data from the task analysis phase of the ADL research provides some guidelines regarding what types of assistive technologies might be most appropriate for this older population. Let me give you an example from these data to explain. Figure 1 illustrates a component map or task demand profile for one ADL, changing bed linens. Many older people report having difficulty completing this task. Moreover, homecare services report that this is one of the most often requested services provided to older persons living at home (5). Looking at the demand profile you can see that the most frequent postures assumed in the performance of bed changing are lean reaches and bends. The working height (bed height) for this task is on the average 22". Given what we know about decreases in spinal flexibility and balance recovery in older age, it is not surprising that this task is difficult. When age related disabilities are present (*e.g.*, arthritis, osteoporosis), successful accomplishment of this task is further compromised.

A solution to this problem could include the design and use of a bed that is easily raised to a more appropriate working height for older persons to change bed linens and then easily lowered to an appropriate ingress and egress height. (In fact, there is a product like this currently being brought to market.) Our auxiliary database of anthropometric and biomechanic capabilities of older persons can be used to specify the appropriate minimum and maximum heights for this technology with task specific heights being determined by each individual user. You can see from this example how data from daily task performance can be used to identify

potential users and specific technologies (and design parameters for these technologies) appropriate for these users. More details regarding this approach can be found elsewhere (6)

Unfortunately, this still does not get assistive devices into the hands of older users. This is a much more difficult problem. There are several reasons why this lack of technology transfer exists. As with all groups lack of funding for devices, particularly ADL related as opposed to "medically necessary" devices plague applications with older populations. In addition, education of users as to the existence and benefits of assistive technology is virtually nonexistent. With regard to professionals, few who have regular contact with older persons (*e.g.*, physicians, clinic personnel, home care aids, case managers) have even minimal knowledge and understanding of what and where assistive technologies are available for older persons. Typically, this has been the sole purview of occupational and physical therapists who see patients primarily on an acute care basis and tend to prescribe assistance from a specific disability perspective. Vanderheiden (7) has provided an excellent discussion of these problems with regard to service delivery mechanisms that applies to all age users of assistive technology.

The elderly as consumers of technologies have not typically been very approachable. As a group, the elderly have strongly resisted the label of disabled, and unfortunately, this is the exact image that most assistive device technology carries, particularly since the primary distributors of these products are medical supply stores. Ironically, a vicious cycle of technology wasting continues. Device designers do not have incentive to produce better and nicer designs when the older consumers do not seem to be a viable market for these products. In concert, older consumers continue to be reluctant about buying products that carry a medical, disabled connotation. Recently, however, a new trend is being seen in this area. Devices are now being designed with more attention to the aesthetics of the design. In addition, presentation of these devices is also moving toward one of a more aesthetically pleasing format.

The Technology Center for Independent Living at the Miami Jewish Home and Hospital of the Aged has taken a comprehensive approach to marketing and providing assistive technology to older persons. We have developed four major components to our program to accomplish the goal of provision of services, products and information regarding assistive technology for the elderly. Let me briefly discuss these four components (Note: Slides of the Technology Center exhibits accompany this discussion).

The education component is geared to both older consumers and professionals. Seminars are held which are targeted to specific groups. For example, housing design seminars are held for architects and interior designers to provide essential information regarding the need for and specification of appropriate environmental design for older adults. Health care professionals are a primary target group as these persons are the most frequent contacts for frail

elderly in need of services. Both formal and informal caregivers are included in this group as both have proven to be most active in seeking alternative or additional solutions to the care of their clients or loved ones. Currently, educational packages including print, audiocassette, and interactive video are being designed for more widespread distribution.

Two in-house displays have been designed the second component augments the education component to provide a direct hands on experience with assistive technology for consumers and professionals. Our Showcase Display highlights new and prototype designs for the kitchen and the bathroom. This display was developed to serve as a spring board for designers, developers and other professionals to create new assistive environments for the elderly. The other display is our Technology apartment. We have designed a unit with one bedroom, kitchen, living room, and bathroom to mirror typical South Florida apartments. We have made an extra effort to give a very home-like feel to this unit. Within each area, assistive devices are set up in their natural environment (*e.g.*, jar opener with a jar in the kitchen). Groups of older persons (and professionals) are brought to this unit, devices and environmental modifications made (*e.g.*, lowered rod in the closet) are explained and demonstrated, and visitors are encouraged to walk around and try out the various technologies. Work has begun on bringing focus groups into this environment to provide valuable feedback regarding assistive technologies displayed.

Because not everyone can get to our seminars or in-house displays, particularly the frail elderly, we have designed the third component, an outreach exhibit containing various assistive technologies. This exhibit is a unique display that allows for handling and trying out of devices but all devices are permanently attached so that this exhibit can be left for an extended period of time to maximize exposure. The target locations for this exhibit are mall shows, fairs, senior centers, apartments, congregate housing and other nursing homes.

Finally, the actual sale of assistive devices is our fourth component. Selling low tech assistive devices is not easy as evidenced by the frequency with which distributors (both locally and nationally) go out of business. We have taken a somewhat different approach than most with our concept of Team Independence. Team Independence is composed of professionals, including occupational therapists, social workers, architects, and interior designers who work together to deliver appropriate products and services to older persons, their families, and health care systems throughout South Florida. This is our newest and most exciting endeavor. The director of Team Independence completes an initial task based person and environment assessment and designs a preliminary program of intervention depending on need and desire of the consumer. The service package available includes major and minor architectural re-design, interior re-design, simple home modifications (*e.g.*, lower closet rods), prescription for assistive device use, behavioral and physical interventions, and referrals for

medical and psychological care. Potential consumers can obtain any part of the service package they desire (*e.g.*, assistive devices only). Contractual arrangements with screened professionals are developed to provide the various service components. Assistive devices are sold through the Technology Center and prescribed by an Occupational Therapist on contract with Team Independence. Contracts with manufacturers to distribute assistive technologies are being negotiated to supply devices. Currently, devices are provided through subcontracts with other distributors. Marketing and promotion of Team Independence services are accomplished by a marketing director on staff. We are very excited about this endeavor and are looking forward to bringing this project up to full speed in the very near future.

In this presentation I have attempted to provide you with information regarding the need for a more comprehensive approach to providing assistive technology to older persons. Our particular approach at the Technology Center for Independent Living has its roots in basic research, and the support of a strong, service oriented organization, The Miami Jewish Home and Hospital for the Aged. With these assets we are attempting a multi-level approach to the promotion and provision of technology and services to community dwelling elderly. The efficacy of this approach awaits the test of time but initial feedback from consumers and professionals has been positive. We hope that through our efforts and those of others in both gerontology and reabilitation field, we can enhance daily life for all people, regardless of age.

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Table 1

Percentage of Individuals Who Reported at Least One Problem with Daily Living Tasks

Task Category	Group			
	Males[a]	Females[b]	Total[c]	X^2
Household Tasks				
Meal Preparation	40	47	45	.5
Grocery Shopping	46	55	53	1.3
House Cleaning	5	39	31	21.2***
Laundry	5	14	12	2.2
Personal Tasks				
Dressing	23	35	32	2.6
Bathing	16	33	28	5.2*
Grooming	16	32	28	4.9*
Transfer Tasks[d]	10	34	28	10.8***
Management Tasks[c]	10	14	13	.2

Note: The chi-square statistics have been adjusted using Yeat's correction.

[a] $n = 57$. [b] $n = 184$. [c] $n = 244$.

[d] Getting in and out of bed, chairs, bathtub, etc., or using stairs.

[c] Using telephone, accessing mail, operating locks.

* $p < .05$. ** $p < .01$. *** $p < .001$

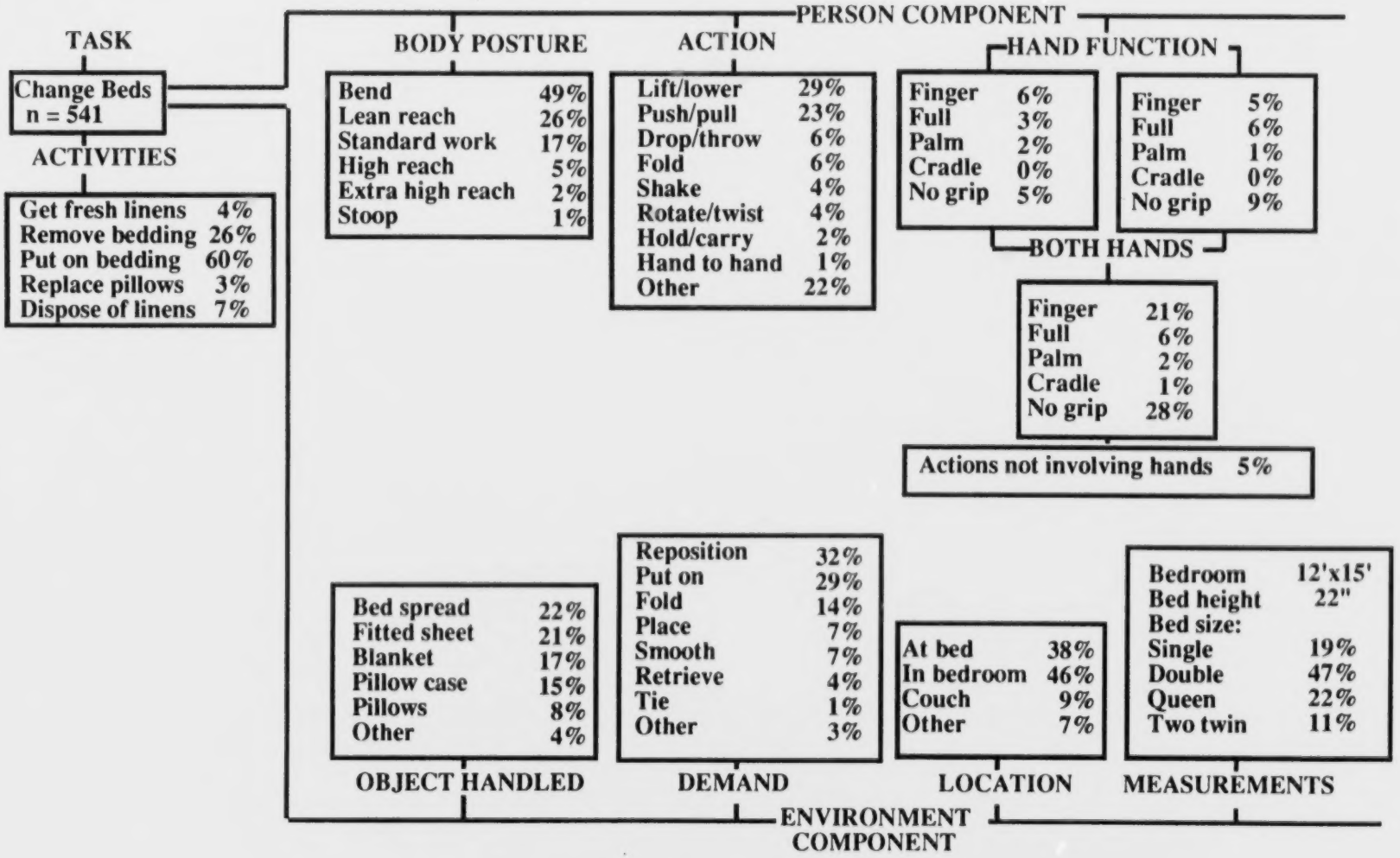

Figure 1. Task demand profile for changing bed linens.

Research Focusing on Freedom of Choice, Communication, and Independence Using Eyegaze and Speech Recognition Assistive Technology

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Bioengineering Program

People with disabilities have realized numerous benefits through the application of contemporary technological advances. The Association for Retarded Citizens of the United States is committed to insuring that these benefits are enjoyed by this country's 6,000,000 children and adults who are mentally retarded. Recognizing not only that technology was finding its way into everyone's life, but also that it could be applied to special problems that had eluded satisfactory solutions, the ARC established its Bioengineering Program in 1982. The Bioengineering Program, as a research and development program, has three major goals: first, to investigate procedures and techniques that improve the use of existing technology by children and adults with mental retardation; second, to develop new assistive devices and systems to address unmet needs; and third, to provide technical assistance to parents and professionals.

Research Need

There are more than two million children and adults in the United States whose physical and/or mental impairments are so severe that they are unable to communicate with other persons or interact and learn from their environment in an effective manner (Bricker & Filler, 1985). Disabilities of this degree impact people with cerebral palsy, paralysis, spina bifida, mental retardation, and cardiovascular disease/stroke, and severely limit their ability for independent living, effective education, and productive employment. Individuals with severe physical impairments are frequently bed- or wheelchair-bound with very limited control over even gross motor movements. If it exists at all, oral communication is oftentimes limited at best, with the degree and combinations of disability impacting the severity of this problem. Individuals with severe disabilities are usually totally dependent on others to discern their basic needs such as thirst, hunger, or toileting, and to act on those needs. They also are prevented from exercising simple choices that are in line with their desires, such as turning on the TV or listening to music. Caregivers, family, therapists, and teachers struggle to find a pathway to assist these individuals in functionally effective ways. For lack of such a pathway, even personal computers with their unique educational strengths are powerless to facilitate their developmental progression. Often these individuals are denied by their handicaps and society's response (or lack of response) to them the social interaction, opportunities for education and

productivity, and personal fulfillment to which everyone is entitled. Caregivers, teachers and therapists are also severely impacted by these multiple handicaps in that they are required to provide extensive and near constant attention (Fredericks, 1985).

Despite the serious need that has existed to compensate for the limitations and extend the abilities of individuals with severe physical impairments and possibly mental retardation, until recently these individuals have largely been ignored in the development of technology-based aids and related training procedures. Very few of these people possess sufficient motor control to use a computer keyboard, and current attention has almost exclusively focused on the use of physically-operated microswitches as alternate access modes (*e.g.*, Ellington, 1986; Esposito, 1985; Meehan, Mineo, & Lyon, 1985; Parette, Strother, & Hourcade, 1986; Wright & Nomura, 1985; Torner, 1986). In recent years, researchers have begun to address these serious needs in more creative ways with the cutting edge technologies of voice recognition and eyegaze/headpointing (Brown, 1989; Brown & Cavalier, 1989; Brown, Cavalier, & Tipton, 1986).

Bioengineering Speech Recognition Research

According to Raymond Kurzweil, it is recognized that speech recognition as a means of interfacing a user with handicaps "offers real hope for personal communication, education, and gainful employment. Voice is the most natural, effective form of communication" (Weintraub, 1987). Not only is voice recognition recognized in the field of disabilities for its potential, but in the business arena it is acknowledged that "when combined, natural language and voice recognition represent one of the most significant advances in the history of computers" and that by the mid 1990's voice input will be the rule rather than the exception for computer control (Lazzaro, 1986).

Since 1984, staff from Bioengineering Program have been developing a research track called the Freedom of Choice and Independence which utilizes speech/voice recognition technology or eyegaze/headpointing technology for freedom of choice, communication and environmental control. Brown (1985) and her colleagues have sought to improve access to the power of the microcomputer in extending control over one's immediate environment and to communicate in a normalized fashion to people with severe/profound mental retardation and severe physical impairments (Brown, Cavalier, & Tipton, 1986; Carr, 1989).

Speech Recognition, Phase One: Environmental Control

The first phase of the speech recognition research involved the development and field-testing of a prototype computer-based assistive device and accompanying training procedures that allowed a profoundly handicapped person to experience independent choice selection for the first time in her life. The participant in this research was a 42-year-old woman who lived in an institution most of her life, who possessed no self-help skills, who had almost completely

unintelligible vocalizations, who was evaluated as profoundly mentally retarded with an IQ of 19, and who was confined to a bed or gurney-chair for the entire day. She learned through application of an innovative training procedure how to activate appliances and devices in her environment with vocalizations. The vocalizations did not even have to be words in the traditional sense; the computer system was programmed to respond to whatever utterances the woman could produce. This was the first time the use of such technology was ever attempted with a person with such severe handicaps (Brown, 1985).

Prior to Brown's research it had not been determined whether people with profound mental handicaps could understand the cause-and-effect relationships central to successful operation of such a system and learn to purposively use such technology, or if the benefits of such use would be substantial. Brown's results demonstrated the power and utility of such a system in increasing such individuals' functional control over their surroundings as well as improving their self-perception and the expectations of others around them.

Speech Recognition, Phase Two: Sound-to-Speech Translation

From the experiences with the woman who participated in the phase one research, the ARC identified additional features that would make the speech recognition computer system more useful and powerful. Therefore, the second phase of the speech recognition system resulted in the development of the Sound-to-Speech Translation (S-T-S) system prototype and software which adds communication output and new operational enhancements to the environmental control and VCR operation. The S-T-S translation system is designed as a direct selection assistive device and it has undergone multiple rounds of alpha testing in 1988. As a result of these tests, system refinements were incorporated in terms of speed of output, ease of training the voice templates, and increased accuracy of data recording and data reduction.

Research results from field testing indicate that the S-T-S translation system is technologically effective and well-designed. Behavioral data indicates that the subjects, who are severely mentally retarded and physically involved with only the rudiments of language, are learning to use the S-T-S system to begin to map out the cause-and-effect relationships in the environment are learning the practical referential meaning of single-syllable utterances for communication (Carr, 1989). From this foundation, the system can also be used to teach the fundamentals of combining two items to increase communication versatility.

Speech Recognition, Phase Three: Sound-to-Speech Recognition with Graphics

Although the S-T-S Translation system proved to be effective, areas for improvement of this first S-T-S translation prototype have been identified. Phase Three of the S-T-S device will maintain and build on the features of the Phase Two prototype with the exception of

configuring phase three to accept generic VCR models. The device would be greatly enhanced and it would benefit more users, both sophisticated users and lower cognitively functioning users, if the following modifications were made.

The software is being redesigned so that the user can be presented with a menu selection of options which can be accessed with one or two vocalizations through a scanning process. The user or assistant can specify the speed of scanning. The user will have the option of directing the communication output to a printer in addition to, or in place of, the speech synthesizer. The system can be reconfigured to interface with a color scanner which will allow a user a defined array of photographic quality stimuli to be used in the menu array of selectable options mediated through a reconfigurable friendly dynamic visual display. The user can communicate in an "immediate" mode in which each single input is immediately output in its corresponding translation. The system will also communicate in a "delay" mode in which the system holds each successive input in a queue and then outputs the complete spoken translation upon command by the user. The software is being expanded to permit voice operation of a telephone.

Bioengineering Eyegaze Research

There are two main reasons for employing eyegaze-based and headtracking aids over more conventional body movement-based aids. First, a large portion of the population of individuals who are severely handicapped (those who are severely spastic and paralytic) do not have any other reliably controllable body movements. Second, even among those people with other reliable body movements, headtracking and especially the eye's response time (20-30 milliseconds) (Tello, 1988) are much more rapid and less fatiguing. Rapidity and ease of constructing a message are typically the determining factors between a person voluntarily using a communication aid and using it only when required to do so. The minimal expenditure of effort that eyegaze head movement entail and the high speed of use that they offer a person makes them tremendously promising for applications to people with severe handicaps. Recent developments in this technology now make such an access mode possible.

While eyegaze technology was initially developed for military purposes, since 1976 several researchers have conducted pilot projects on its potential to circumvent the problems associated with other technology approaches for people who are severely disabled (Demasco & Fould, 1982; Friedman, Kiliany, Dzmura, & Anderson, 1981; King, 1984; Rosen, Drinker & Dalrymple, 1976; Schneider, 1982; Sutter, 1983). This experimental research has been done only with severely motorically-impaired persons and the researchers agree that there is a need for a more concerted and diligent effort to further this body of knowledge (Angelo, Deterding, & Weisman, 1989; Smith, Christiaansen, Borden, Lindberg, Gunderson, & Vanderheiden, 1989).

Early in the development of eyegaze technology for assistive device application, Demasco and Foulds developed an ocular controlled device prototype and conducted research using a mechanical eye with a charged-coupled device video camera (Demasco, 1986; Demasco & Foulds, 1981; Demasco & Foulds, 1982). Their research gave positive indicators about the potential for further research and development in the area of eyegaze technology. Most products are specifically designed for either headpointing or eyegaze with the exception of the Eyetyper, which can do both.

Since 1987, findings and strategies developed from the voice recognition research have been extended into the arena of eyegaze/headpointing detection technology through research funded by the Office of Special Education Programs (Brown & Cavalier, 1989). This first phase of research has been devoted to answering fundamental questions about what features are needed in assistive technology that are controlled through a user's eyegaze or headpointing to open up the world of advanced technology to children and adults with severe mental retardation and severe physical impairments. The plan of the project was to design and develop the eyegaze and headtracking prototype hardware and software and to test the systems. The second and concurrent plan was to design and implement specific student training procedures to use with the students and teachers. Bioengineering staff have completed the eyegaze/headpointing prototype research and development and field testing in the Dallas and Arlington schools.

The ARC research staff adapted a Sentient Systems Eyetyper and through modification greatly enhanced this system and developed a new prototype/device so that:

- it has an enormously improved ability to accurately recognize where the user is looking;
- it collects data for each user as s/he interacts with the device for research and tracking purposes;
- the software has been modified so that a single device can be selectable not only for eyegaze but also for headpointing;
- the spoken output can be digitally recorded in any voice with the spoken output sounding like totally normal speech instead of synthetic speech;
- the speech output can be recorded on a computer and then transferred back to the device, thus multiple speech outputs can be saved and recalled at will;
- there is an increase in the display for the number of choices which can be displayed for the graphics;
- the prototype/device has the ability to control up to 256 electrical appliances in the environment;

- it is interfaced with a computer for system software upload and download which allows for individualized configuration of the system from one user to the other; and,
- it is totally portable with a 24 hour charge.

Research Findings

Preliminary evaluation of the research data and project materials from this eyegaze/headpointing research indicate several important findings.

- The subjects have learned to effectively use the technology. They display a variety of physical characteristics with varying degrees of spasticity, athetosis, hypertonia, and hypotonia. The proper seating of the subjects is critical to their ability to effectively utilize the technology with more of the subjects being effective headpointers than eyegazers.
- The subjects are benefiting educationally, socially and emotionally from the entire gestalt of the field testing, the technology, and the research implementation.
- The subjects' affective behavior primarily indicate involvement with the task of using the system, followed by a demonstration of pleasure at having control and decision-making ability.
- The hardware and software used for this research was developed from existing technology (*The Eyetyper*) and has been modified dramatically. The technology, even in a modified state, has been difficult and limited in its ability to address the needs of the subjects in this research project. Limitations in its ability to quickly and easily calibrate where the user is looking when first seated in front of the device is a major shortcoming. This is especially true for subjects with lower cognitive abilities.
- Significant training strategies can be developed for teachers, clinicians and parents on head positioning and control for use in future implementations with other users.

Summary

The ARC is excited about the ongoing research in assistive technology in the Bioengineering Program. The track of research on Freedom of Choice and Independence is demonstrating the incredible potential that technology can have for people with disabilities. And more importantly the abilities of the individuals with severe handicaps who use the technology and are now have the freedom to tell the world for the first time about those abilities and their individual choices.

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The Process of Integrating Software into the Special Education Curriculum

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When considering the effective use of technology, the term, "integration" is often used. The goal of integrating technology into the curriculum is to link software and computer activities such that they facilitate the teaching and learning of specific learning objectives. This view is commonly referred to as "curriculum correspondence" and is useful to consider when planning for the integration of technology into the curriculum.

The process outlined in *Figure 1* describes what I perceive to be the major tasks involved in selecting, acquiring, implementing, and integrating software into the curriculum. The tasks appear to be generic in the sense that the process is the same regardless of ability level, subject matter, or type of computer.

Understanding this process appears important for three reasons. First, it provides teachers, teacher educators, and administrators with a planning outline of how to go about integrating software into the curriculum. Further, it highlights the time, energy, and resources which must be committed to successfully implement a computer instructional program. And finally, it offers resource organizations such as the Technology Center a framework for developing services to support your efforts.

Overview

Figure 1 outlines a somewhat linear progression of tasks involved in successfully integrating software into the special education curriculum. Page 2 provides a list of questions which might be raised in working through each task. Please note that many other questions could, and should, be raised in each task.

It is my impression that the process is recursive, and therefore, while phase one may result in the identification of a number of potentially useful programs for a given objective,the rest of the process will need to be repeated with each software program. Thus, it becomes readily apparent that this process entails a significant commitment of time and effort. As a reasonable goal, I suggest that teachers initially work through this process until they have found 3-10 programs which will support the varied needs of their students.

THE INTEGRATION PROCESS

PHASE 1 SELECTION	PHASE 2 ACQUISITION	PHASE 3 IMPLEMENTATION	PHASE 4 INTEGRATION
Planning	Previewing	Organizing	Linking
Locating	Evaluating	Teacher Training	Managing
Reviewing	Purchasing	Student Training	Extending
Deciding			

Figure 1

Phase 1: Selection

Planning: What kind of software is needed? What instructional goals could be facilitated by using educational software? Will the nature of students' handicapping conditions require special hardware or software? What standards will be used to identify high-quality software?

Locating: How do I find the kind of software I need? What local resources will help me locate software? What other resources are available to assist me in this task?

Reviewing: How can I learn more about a specific program? Have any of my colleagues used these programs? Can I eliminate any programs from further consideration at this point?

Deciding: Based on the information available to me, which program(s) tentatively appear to meet my needs, within my budget? Will the programs I have tentatively selected work on my equipment?

Phase 2: Acquisition

Previewing: Do I have all the necessary information to place an order to preview a program? What should I know about ordering a program for preview? What should I consider if a program can be purchased from more than one source?

Evaluating: Once a program arrives, how do I determine if it is instructionally sound? What reactions do my students have to the program? How well does the program meet my original objectives and expectations?

Purchasing: What factors should be considered in deciding to purchase or return a program? What should I know about the replacement policy? How do I become a registered owner?

Phase 3: Implementation

Organizing: How do I store my software and the related documentation? How can I organize my software collection? What can I do to make it easy for my students to use?

Teacher Training : What are the major objectives of the program? What skills and knowledge are required to use the program? Will special instructional strategies be required for the students to successfully use the program? Have I mastered the mechanics of using the program?

Student Training : Do I have the necessary skills to successfully use the program? Have I mastered the mechanics of operating the program? Can I use the program independently?

Phase 4: Integration

Linking: When should the program be used so that it corresponds with the existing curriculum? How can it be best used to facilitate learning? What activities would be useful both prior and subsequent to a program's use by students?

Managing: How can I provide time for all students to use the program? What other materials should be made available at the computer? How do I ensure that all students are successfully achieving the objectives of the program?

Extending: How can I extend the shelf-life of a program, that is, what other objectives might a program facilitate? When would be an appropriate time to reschedule the use of a program as a probe for the maintenance of skills?

Telecommunications Technology in the Future: Its Benefits and Applications to Persons with Disabilities

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Introduction

Southwestern Bell Telephone's commitment to customers with disabilities goes far beyond providing regular dial tone service...and even beyond our charitable and volunteer activities. We have the technology and the capability to offer services that could dramatically improve the level of convenience, security and independence enjoyed by persons with disabilities.

We have new technical innovations that we are offering to our telephone customers. Put simply, it's the technology that gives the phone system such tremendous potential. But to fully grasp that potential we need to broaden our idea of what's meant by the "telephone"..and what it can do for people.

Earlier this century, people saw the telephone as a link to the local community, and later, to the entire world. And not too long ago we considered the phone as a fixture on a wall or a desk. Now, of course, it's something you can take with you...in your car or briefcase.

But today we're in the middle of *an even more significant* transformation. Millions of calls everyday are sent back and forth between callers by centralized switches--switches that are actually computers. They're sophisticated computers that send information in the form of electronic impulses over the phone system.

And it takes a lot of computing capacity to provide the quality and flexibility you're used to. New capabilities are also emerging.

So no longer is your telephone simply a device for having a conversation with someone. It's a link to a computer that can (a) increase your home security, (b) provide enhanced emergency coverage, (c) let you shop without leaving home, (d) transmit your choice of home entertainment without a trip to the video store, and (e) and even deliver medical treatment. As you can imagine, services like these become especially valuable for persons with disabilities.

Our research shows that persons with disabilities are, in fact, among the most avid users of telephones and telephone services. The "good news" is that new communications services can *bring* down even more barriers to persons with disabilities *and* increase their ability to live independently.

Many people already take advantage of services like *Call Waiting*, a service that allows you to know another incoming call is waiting when you're talking, or *Speed Dialing*, the service that allows you to program phone numbers and call them quickly by pushing just two buttons. Or perhaps you're already familiar with home shopping or banking...or even tapped into a computer data base. As services like these become more advanced and more widespread, the means of accessing them remain simple.

The door to many of these new services is the push-button phone. We're gaining insight in this area right now through several trials under way in our territory. Beyond our trials, we're already introducing some new services that will give all of us, especially persons with disabilities, greater control over our telephones and our lives *without requiring any new equipment*.

For example, are there some callers you'd rather not hear from again. Then our *Call Blocker* option is for you. By simply pushing some buttons on your Touch-tone phone keypad, *Call Blocker* blocks calls from whatever phone numbers you wish. Our *Call Trace* option can also allow you to trace and record the time and date of a threatening or offensive call you or someone in your family receives.

These are just two of the Call Control Options we've begun offering in some locations. Customer response to these new options has been phenomenal.

The fact is that all these new services involve new ways to manage information. They also offer security to those living alone, added independence to persons with disabilities, and overall convenience and efficiency to those who rely on the phone each and every day. But best of all, these features are very easy to use. Most importantly, our customers who have disabilities have said they like them.

There are many new applications of phone technology in the medical area where medical information like heart rates, and even cardiograms can be sent over the phone lines. The technology is already improving access to medical care in rural areas. And in the future, the telephone will let doctors monitor our health from their offices while we stay at home.

We're also excited about the *Voice* and *Data Gateway* trials -- the largest consumer trials in the nation--now under way in Houston, Texas. Using the *Voice Gateway*, a customer can dial and receive a variety of recorded messages and simple instructions to access a wide range of information. While using the *Data Gateway*, a customer sees listings for information and entertainment options on a simple video terminal or personal computer screen.

Over a million people will have been involved in the Gateway trials before they conclude next year. The *Gateway's* possibilities are nearly unlimited. For persons with

disabilities, the *Gateway* could offer information on shopping from home, travel, special community events, health care, photography, sports, dining, and the list goes on and on.

All these gateway services are literally at a person's fingertips:

* enter the voice gateway with a regular push-button phone;
* a simple, easy-to-use video terminal that the phone plugs into is all that's needed to access the data gateway; and
* information is provided by following a series of simple keyboard commands.

You may be surprised to learn that Europe and the Far East are far ahead of us in bringing the advantages of *Gateway* services to their people, with particular advantage to persons with disabilities. The French government is subsidizing its *Gateway* service as part of a multi-billion-dollar program. They've actually given away nearly *six million* of the simple MINITEL video terminals that access the gateway. The French MINITEL has over 10,000 services which include retirement planning, insurance, health care and social services.

The bottom line is that these services offered in other countries improve the quality of life for persons with disabilities. We want to provide services that are practical and useful for people; such things as voice dialing, and touch screens can make access to Information Age services easier and quicker because they can do even more to overcome the barriers to movement, sight or hearing.

The future of telecommunications holds much promise. These services will be easy to use and they will be affordable, but most amazing of all, the technology that will make them possible *already exists!* We could offer these "futuristic" services *without waiting* for a single technological breakthrough.

But we are waiting for another kind of breakthrough--a breakthrough in the way Southwestern Bell is regulated. We now operate under an outdated form of regulation that makes it very difficult for us to offer the kinds of services that would be most valuable to older adults.

Outdated regulation presents us from offering the full range of information services, and it even complicates our ability to upgrade our network with the technology to make new services possible. We're restricted from offering certain products and services, and what we need to remedy the situation is a change in government policy and rules that govern how we're regulated.

Basically, Southwestern Bell and the other Bell holding companies are hobbled by federal restrictions left over from the agreement that broke up the Bell system, and outdated regulatory policy at the state level. For example, federal policy says we cannot provide the

content of information we transmit; we cannot manufacture telephone equipment; and we cannot offer most long distance service.

These policies are major obstacles between us and offering "expanded opportunities" for the aging and others in the phone network.

Conclusions

The problems are many, but they're manageable if we can get the kinds of regulatory reforms we're looking for. The crux of this issue is that traditional regulation discourages us from making the major investments in our network today that are needed to usher in the Information Age. It prevents us from bringing the kinds of services I've described to all our customers and consumers nationwide. Again, what we need is broad regulatory reform at the state and federal levels.

There's a lot on the line because we're talking about the need for large-scale, long-term investments. Put simply, government policies and the age-old state regulatory frameworks cannot withstand the pressures of competition, technology and consumer demand...something's got to give.

We want to ensure that persons with disabilities receive the advanced, affordable services that will enrich their lives with convenience, security and independence.

The Arkansas Special Education Resource Center Presents Software Soup

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In September 1984, The Arkansas Special Education Resource Center established the Technology Advisory Committee to guide their Special Education Technology Specialist. This committee determined that the state was facing two high priority goals - the establishment of a Student Data System to manage on a local level information gathered on students in special education programs for easy compilation of local, state, and federal reports, and the establishment of a Computerized IEP. The steps in reaching these goals were not only challenging, frustrating, and sometimes exhausting, but also exciting and rewarding.

The products developed in attaining both goals are a tribute to the hard work of many people, but most especially to that of a dedicated programmer.

The Arkansas Student Data System

The computerized Student Data Management System, which has been in operation for five years, is a comprehensive system which tracks students receiving special education services from the point of referral to termination of services. The data bank, entered on an individual student basis, is arranged into six areas:

1. Basic General Information:
   addresses name, address, parent name, birth date, telephone number, sex, race, grade and emergency telephone number.
2. Evaluation Information:
   addresses evaluation date, primary and/or secondary handicap, severity rating of the handicap and annual review date.
3. Programming Information:
   addresses up to six areas of programming found on the IEP and related services.
4. Placement Information:
   addresses placement date, type of placement, building or agency, and district providing the service and temporary placement.
5. Funding Information:

addresses the source of funding, either PL 89-313 or VI-B, for the student.

6. Termination Information:
   address reasons for termination plus anticipatory services indicated for the student once special education services are no longer necessary.

A variety of local reports may be generated, such as alpha lists by race, sex, teacher, building, primary and/or secondary handicapping condition, related services, funding sources, terminated students, and re-evaluation. These alpha lists can be used in a number of ways, for example, establishing class rosters, related service rosters and re-evaluation schedules.

State and federal reports can be generated by the program. Districts using the system submit a copy of reports along with the diskette in lieu of a written report, enabling the Arkansas Department of Education to compile state and federal reports more effectively.

Emphasis is now being placed on the compilation of data to determine program effectiveness and accountability that can be shared with administrators, local school boards and the Arkansas Department of Education. Data can be correlated by teacher, building, race, and/or sex at any step in the due process procedure to ascertain patterns, such as, possible over-identification of students with handicaps within the district, overrepresentation of minority students in special education services, reasons for termination of services, including dropout rates, or the success rate for students being placed back into regular education service.

The Arkansas Computerized IEP

The first steps in what became the development of the "Arkansas Computerized IEP" dealt with the process of deciding whether to purchase a commercial program and recommend its adoption statewide or program one tailored to meet Federal and Arkansas requirements. This first phase involved the review of what other states had done, the development of criteria for an Individual Education Plan program, production of comprehensive Review and Evaluation Forms, review of commercial programs, and lengthy discussions of the advantages and disadvantages of adopting a commercial IEP program which would need to be modified or programming one to meet the state specifications.

For many reasons, the decision was made not only to develop a program tailored to Arkansas needs, but also to develop a data bank of goals/objectives. This decision led to the second phase in the development of the "Arkansas Computerized IEP". This phase focused on the format of the Individual Education Plan, selecting and contracting for authors for the goals and objectives bank, and the writing of the goals and objectives. Much time was spent in this phase reviewing, discussing, and revising goals and objectives. At this point, additional reviewers, including selected local special education supervisors and state area supervisors were involved with the review process.

The Arkansas Computerized IEP addresses all components required by State or Federal Regulations. Additional components, such as the student discipline plan, are included, but are not mandatory. All components and sections allow school districts to enter additional individual information to each listing or section to meet the individual needs of each student. The program is accessed by entering code numbers to identify selected information pertinent to each component. The code numbers plus the matching written material are printed out on the Individual Education Plan. The Data Bank of over 4,500 Goals and Objectives is printed in a hard copy as a Reference Manual. The manual may also be used by school districts who are unable to access the computer hardware.

Phase three, field testing of the program, began in January, 1989, in seven school districts. An initial training session was held with personnel involved in the field testing as well as two networking conferences where progress reports were made and study groups formed. The study groups went through each section of the program and discussed concerns and made suggestions for the final version of the program.

General distribution will be made in the 1989-90 school year. Training and technical assistance will be provided for all participants during statewide distribution.

Three Approaches to the Use of Speech for People Who Are Visually Impaired

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American Printing House for the Blind

At the outset, I wish to point out that this presentation is aimed at those who might benefit from the use of the approaches to be set forth here. It is not intended as a technical paper to acquaint colleagues in the field with work being done at the American Printing House for the Blind (APH). One of the three systems to be described here involves the use of an audio cassette tape recorder specially modified for use by blind people. I will describe its use for reading text recorded onto audio tape and an application as an "audio pencil" for taking notes and capturing information.

The second system is an input/output system which contains a braillewriter style keyboard. This system uses synthetic speech to monitor key strokes as they are entered as well as for the purpose of proofreading text for accuracy and content.

Finally, I will describe new screen reading software especially designed for the Apple II-GS. It is intended to make available to visually impaired people access to applications software not designed for speech access.

Taperecorder

The tape recorder mentioned above is the Handi-Cassette tape recorder (1). This is a four-track two-speed machine which also permits playback at variable speed in addition to the two fixed speed settings. The machine also contains a built-in speech compressor. Its tone indexing control allows the user to mark recordings as they are being made for efficient location of pages and chapters. All four tracks can be used for recording. Thus, a single C-90 audio cassette can hold up to six hours of recorded information.

The machine, originally marketed by General Electric as the "Fast-Track" has been withdrawn from the commercial market. However, the version modified specifically for blind users continues to be available. Modifications designed to enhance usefulness of the machine to blind consumers include the features just mentioned as well as raised markings on the various control buttons which facilitate their quick identification and efficient manipulation.

For those unfamiliar with some of the features embodied in the machine, a brief explanation is appropriate.

Compressed Speech

When a recording is played back at a speed faster than the speed at which it originally was recorded, at least two things happen. First, the recording can be played in less time than is required at normal speed. Second, the pitch of the recording rises as a result of the increased

play speed. Thus, if middle C on the piano is recorded on tape and that tape is played back at twice the recording speed, the recording can be heard in half the time, but middle C will have been raised one octave in pitch. It will have been doubled in frequency. Using such a technique, a piano can be made to sound like a tinkling music box.

When recordings of speech such as Talking Books prepared for use by blind readers are treated in this way, the voices of narrators tend to resemble Simon, Theodore and Alvin from whom we often hear, especially around the Christmas season.

Many users of Talking Book recordings have learned to listen to and understand recordings played in this way. This ability is an invention born of the necessity of reading much material in limited time; a common condition for students. Compressed speech or "Variable Speech Control", as it is called in connection with the Handi-Cassette recorder, is a process by which a recording can be played at a high rate of speed but without the resulting change in pitch. To gain an appreciation of the process, let us suppose that a narrator prepares a one hour recording of text. The recording is made at a tape speed of 15 inches per second. Now, let us very carefully cut the resulting tape into half-inch lengths and number each segment. Next, using splicing techniques, let us join all of the odd numbered segments together. Again, join all the even numbered segments. The result would be not one one-hour recording, but two 30-minute recordings containing brief samples of the voice of the narrator with essentially the same text material. Each recording would contain the same words in the same order, but with slightly different sound elements of those words. The narrator would sound as if he were talking at twice his normal rate. The recording could be heard in one-half the original play time. With compressed speech, this is what happens electronically rather than mechanically. Tape is not physically snipped into segments and rejoined. However, through electronic sampling associated with playback speed, the same result is obtained.

Books prepared by Recording for the Blind (RFB) (2), the National Library Service for the Blind and Physically Handicapped (NLS) (3), and other agencies throughout the country are issued at cassette play speeds of 15/16 inches per second. This is a special cassette speed normally not available in commercial machines. If a 15/16 IPS recording were played at twice this speed (1 - 7/8 IPS), the chipmunk speech would be heard. If compression were introduced, the narrator would seem to be speaking more quickly and a 90-minute recording could be played in 45 minutes. However, since the speed of the Handi-Cassette recorder is adjustable above and below the two fixed settings of 15/16 and 1 - 7/8 IPS, it also is possible to increase compression by speeding up the 1 - 7/8 IPS recording and adjusting the compression rate control. In such a case, one can approach almost three times the original reading rate of the narrator. A 90-minute recording can be listened to with reasonably good comprehension in from 32 to 35 minutes using this extension of speech compression.

For those interested in exploring compressed speech to increase study efficiency, textbooks available from RFB and others can be used. However, if one is having material recorded personally for ones own use, I suggest that recordings be prepared under best possible conditions. Have the narrator talk as close to the microphone as possible and use appropriate wind screening techniques to minimize plosives and other breath sounds. This technique also reduces room echo and background noise, two elements which contribute nothing of value to a recording to be compressed. Since the effects of compressed speech are noticeable only in playback rather than in recording, compression is a process associated with reading. On the other hand, Tone Indexing, one of the features touched upon earlier is associated with using speech and audio to "write" notes and to find them more efficiently at a later time.

Tone Indexing

On the Handi-Cassette tape recorder as well as the larger cassette recorder which the American Printing House offers (4), there is a tone indexing button. When a recording is being made, pressing the tone index button places on the tape a low pitched signal. Though not quite sub audible, the signal is low enough in pitch to avoid being distracting when the recording is played at normal speed or even when it is compressed. However, when tapes are run through in the fast forward or fast rewind modes, the low pitched tones stand out as clear high pitched beeps quite distinct from the busy chatter associated with human speech running at fast speed. Indexing tones can be used to mark page breaks in textbooks, chapter and section headings, etc. With a bit of care and thought, the indexing signal can be modulated to give expression to these signals. The button can be held down to produce a long steady tone. It can be held down for long periods of time with short interruptions of silence. It can be pressed to produce short pulses with longer silent intervals between them. When played back the resulting signals are quite distinct and easily identified.

In normal operation, tone indexing signals are only placed on a recording at the time the recording is being made. If there is special need to have a recording indexed after the fact, one must use a second tape recorder and copy the recording which is to be indexed onto a blank tape and to place the desired tones on the copy while copying is in process.

If all four tracks of a cassette are used for the recording of spoken word text, the opportunity for making audio margin notes is lost. However, if one is willing to sacrifice two tracks for note taking purposes, noting key topics becomes possible. To do this, one stops the recording at the key point and switches the track selector switch to select the track adjacent to the track containing the key point. Then, tone indexing, a spoken word note or a combination of these can be used to make the appropriate comment.

Foot Pedals and Microphones With On/Off Switches

Almost every moderately priced tape recorder has some sort of remote control jack. This jack allows the recorder operator to install a foot control (5) or a microphone with an on/off switch (6). These are designed to stop and start the tape without having to touch stop and start controls on the body of the recorder. If the recorder is to be stopped and started only occasionally, these control devices are adequate. In the case of recorders designed for use by blind people, these controls often fall short. For one thing, often the tape recorder's record or playback amplifier is cut off when the machine is stopped. Often, when the machine is started again, a significant amount of time passes before the amplifier has reached full power. This time lapse can be as much as half a second. This means that if the user begins dictating too quickly after starting the machine, a word or two of dictation will be lost. In the playback mode, if tape travels when the amplifier is off during stop and start operation, again, words are lost. This means that in order for a machine to be used successfully as an "audio pencil", its amplifier needs to remain on all the time. Tape movement must stop and resume quickly in order to avoid having the tape coast to a stop and start with a snap. Such behavior leads to the build up of tape slack. In turn, this results in tape becoming twisted and valuable data being lost.

In the case of the Handi-Cassette, the amplifier does remain on and start-stop efficiency of tape movement is good.

The Audio Pencil

In my view, far too few people make use of the concept of the audio pencil. Vocational counselors issue tape recorders to blind students who in turn go about recording every word of every lecture. In many instances, one gets the impression that the switch that turns the recorder on turns the student's mind off. What is intended as a study aid often turns into a time waster. Even with the use of speech compression, it takes far longer to play even a single lecture than it would to replay concise notes carefully taken during the lecture. I submit that a much more valuable procedure is for a student to use a start-stop microphone and to speak in a muted voice or whisper low enough to avoid distracting neighbors. The student should speak those notes which he or she would have written with a pencil or on a silent keyboard machine. Then, at review time, notes for several lectures can be examined in the time needed for one 50-minute lecture. The technique requires just a bit of practice, no special keyboard skill, and a willingness to try something new. It also provides good practice in determining what is important and what is not at the time it is said.

Strengths and Weaknesses

The audio pencil approach to information processing has both strengths and weaknesses. Its strengths lie in the fact that to use it, one need not learn any special code, syntax or language. Indeed, to write with the audio pencil one need not know how to spell. Using the note taking technique described earlier, one can write far more quickly than is possible with a keyboard instrument. Using a foot pedal, one easily can transcribe voice recorded notes into a computer or on a typewriter keyboard or into hard copy braille. If one truly does not know how to spell, one can have the transcription done by someone who does. Equipment is light, portable and, as long as battery power holds out, it can be used anywhere.

Two principal weaknesses of this system are found in the serial nature of tape recording and the fact that equipment can fail without the knowledge of its operator. To be of maximum usefulness, notes taken using the audio pencil approach are best transferred to another medium quickly. The other medium, paper or computer storage, lends itself to locating specific bits of information more easily than does trying to find one specific fact tucked away on a long strip of recording tape. If recording battery power is low, or if tape has become twisted, it is possible for the operator to believe that all is well and every valuable note has been recorded up to the very moment he sets about transcribing those notes onto paper or disk.

In most cases, systems do work as they should and, weaknesses notwithstanding, one can make extremely effective use of the audio pencil.

Applications

Students have used this technique to take notes quickly and efficiently and to transcribe notes to a more permanent medium. Blind people employed in radio have used the audio pencil combined with a technique called "parroting" to enable themselves to deliver spoken word information to a microphone at a rate comparable to sighted announcers using written scripts. In the parroting technique, the blind operator repeats onto tape with the audio pencil, information read to him or her by a sighted person. Those who use the technique report that it is easier to parrot ones own voice over familiar material than to parrot the words of another person. Then, having captured the information on tape, the blind person wears an earphone and repeats the recording in the on-the-air situation. This is similar to language interpreters at the United Nations. These people receive input through their ears in one language and output the translated information by voice in another language. In the case of parroting by blind persons, the objective is to enable a blind professional to perform tasks normally thought of as requiring sight.

PocketBraille - Another Approach

Our second approach to the use of speech involves the use of synthetic speech and braille keyboard entry. The device under discussion is the APH PocketBraille (7). The PocketBraille measures approximately 9 inches wide, 5 inches deep and 2 - 1/2 inches high. When resting upon a table, its upper surface contains a seven key keyboard and approximately a two-inch diameter grill area for sound escapement from its internal loud speaker. The rear panel of the PocketBraille contains a standard RS-232 serial port and a parallel Centronics port. Both of these are capable of accepting input and transmitting output. In addition, there is a special port designed to accept an external memory cartridge (8) capable of holding 32 kilobytes of data in non volatile RAM. This port also can accept data from a device called the "Screen Door". Still under development, the Screen Door is a circuit board that plugs into an expansion slot of an Apple II, IIplus, IIe or IIgs computer. It allows data going to the computer screen to be read using the synthetic speech of the PocketBraille. There is another output port intended for connection to an external braille display; also under development.

The rear panel also contains an earphone jack, a power input jack used to charge the PocketBraille's internal battery supply, a volume control and a speech speed/pitch adjustment control. The power on/off switch also is located on the rear panel.

As I have already said the PocketBraille keyboard contains seven keys. To a typist, this will seem too few. Those acquainted with braille writing equipment should not be troubled by this number. Braille, the raised dot reading system used by blind people throughout the world, is based upon a unit called the "cell". The braille cell is two dots wide and three high. Thus, each cell contains as many as six dots and as few as none. Each of the six dot keys on the PocketBraille corresponds to a single dot position within the braille cell. The space bar, key number 7, accounts for blank spaces, cells in which there are no dots. With six dots per cell, 63 active dot combinations are possible within a single cell.

On a mechanical braillewriter, pressing the space bar does only one thing. It allows the escapement to move the writing head without producing a raised dot. In short, it leaves a blank space. The keyboard of the PocketBraille is electronic. This means that its space bar can do multiple duty. Pressed in conjunction with no other key, it transmits ASCII character 32, the space character, into the PocketBraille's memory. When the space bar is pressed along with other keys, it acts as a kind of shift key. It enables the user to issue commands to the PocketBraille's micro-processor. These commands instruct the PocketBraille to do such tasks as set the clock, set the date on the current date calendar, reveal the time and date, enter upper case for a single character, lock the unit into upper case, change volume, amount of ,punctuation or the rate at which speech is presented, delete various units of text, identify ones

location within a document, display the amount of free space remaining within the currently accessed memory.

By way of background for those not acquainted with braille, every character represented in braille must be represented within the confines of the six dot cell. Clearly, with only 63 dot combinations available in a single cell, there are far more characters to be described and defined than there are dot combinations within a cell. In many cases, more than one cell is needed to convey the meaning of a single character. Further, the meaning of a character within a single cell will depend upon the context. In mathematics, a cell containing all six dots has an entirely different meaning that it would if the cell was contained in a musical score or in narrative literary text In literary braille, the braille code in which most literature is printed, there are generally two grades of braille. Grade one is not contracted. That is, there is one to one correspondence between print and braille characters within a document. One exception to this is the need to use an extra cell to show that a given letter is in upper case; capitalized. The letters A through J are used to represent the digits 1 through 0. So, a single cell containing a number indicator must be used to show that what is intended is 3122175 and not the word "cabbage".

In grade two braille, groups of letters which frequently occur within a language are compressed into one or two cells. Thus, the word "internationally" which contains 15 letters is written in grade two using only eight cells. I will write the word, enclosing in parentheses those letters which are contracted into one or two braille characters in order to produce the word: (in)t(er)n(ation)(ally). (Ation) and (ally) each require two cells.

Since Standard English Braille occupies four characters per horizontal inch and five lines for every two vertical inches, a bit of arithmetic will give insight into the bulk of braille. For the most part, books printed in braille are printed on 40-character lines with 25 lines to the page.

The PocketBraille has a braille reverse translator. What this means is that if the user of the PocketBraille uses braille grade two, he or she can write using braille skills and either print out the resulting data in braille or call upon the braille translator to "back translate" or "reverse translate" it from grade two into ordinary text for printing out on a conventional ink printer. This allows a single keyboard entry to produce braille for a blind reader or print for a sighted associate.

The keyboard of the PocketBraille is completely silent in its operation. One can write with it far more quietly than is possible even with a ball point pen. Using the RS-232 port, the PocketBraille can be connected to a modem and used as a computer terminal to transmit data to or receive from a remote location. It also can be used in a classroom to send and receive to and from the school's computer. This means that instructors who have tests done on word

processors can connect PocketBrailles to those computers and have test questions printed out to the PocketBrailles so that blind students can read questions, write answers on the PocketBraille and transmit all answers back to the instructor's computer or print them out on a conventional printer. Because the speech is synthetic, it requires a bit of practice before one can be comfortable with it. Having learned how the machine pronounces certain words, the speech can be used effectively in proofreading a document. If one is uncertain as to a given word, reading can be stopped and the word can be examined character by character. If there is any concern as to whether a given letter is a "b" or a "d" the PocketBraille can be asked to identify the letter by its decimal ASCII value; 98 for "b" and 100 for "d".

Though the PocketBraille has in the neighborhood of 240 kilobytes of user memory, there are times when even this may not be enough. Should the need arise, one can use a Tape Interface Device (9) to transmit data for storage onto audio tape. The Tape Interface Device plugs into the serial port on the back panel of the PocketBraille. A shielded cable connects the tape interface to the input of the tape recorder. Data can be transmitted at a rate up to 2,400 baud. This can free PocketBraille memory for other data. Later, data held on tape can be returned to the PocketBraille via the tape interface. At a transmission rate of 2,400 baud, a single 4-track C-90 cassette tape can store the entire King James Bible, both Old and New Testaments.

Strengths and Weaknesses

Strengths include availability of formats for a standard print and a standard braille page, as well as a user definable format or no format at all. Automatic page numbering in print or braille is available. The instrument also enables one to move quickly from one of six memory banks to another. The parallel port can be configured as an output port. This gives PocketBraille users direct access to many braille and print hard copy devices equipped with parallel Centronics input. The PocketBraille also can be used as a speech synthesizer in connection with computer screen access software. One of its major strengths is the silent action of its keyboard.

The inability to save data in named files is considered by many to be a weakness. The inability to move blocks of text within a document or between them is another issue which is being addressed.

Applications

Many PocketBraille users use the device to take notes quickly, quietly and efficiently. When necessary, a key word search enables them to find specific bits of information within notes far more quickly than would be possible with hard copy braille or print. Because of its ability to transmit units of text by line as well as in larger quantities, the PocketBraille is well suited to the role of message taker. If the message taking operator precedes the name of the

person for whom a message is intended with a unique mark, possibly the @ sign, searching for that name together with its @ will avoid all other messages in which the person's name may occur, but without the accompanying @ character. By placing each message on a separate line, individual messages can be printed out by finding the message and transmitting the line to a printer. One receives only his messages and no others. Where computers are available the PocketBraille serves as a meeting ground for the exchange of information between blind and sighted students.

Textalker GS

Textalker is the software which gives voice to the Echo speech synthesizer series from Street Electronics (10). The Echo plug-in speech cards were among the first speech synthesizers available for use with the Apple II family of computers. With memory management capability not available in the Apple IIe and earlier models, the Apple IIgs offers opportunities for enlarging upon and enhancing the power of Textalker. Larry Skutchan, Systems Programmer at the American Printing House has done this with his Textalker GS, soon to be released. Textalker GS gives speech to such programs as all versions of AppleWorks.

The IIgs supports many desk accessories. The Control Panel is just one of these. Textalker allows blind people to use all of Apple's Classic Desk Accessories virtually as though they had been designed from the beginning to work with speech.

In schools where the IIgs is used, blind and sighted students and teachers can use the same applications programs. Therefore, they can have better communication about common computer issues and concerns.

Strengths and Weaknesses

The strengths of this program lie in its ability to unlock to blind people so much of the software available for the IIgs. Its almost interactive review mode will make operation both easy and efficient.

The principal weakness is that the program uses the Echo speech synthesizer. Echo speech is adequate, but many who hear it for the first time have difficulty understanding it. Given enough time and practice, this condition clears up but if one gives up before understanding is gained, he might be turning away from a major personal break through.

Applications

Since Textalker GS has not yet been released, few people are actually using it except for a few test subjects. However, there is no question that it will find its own place in the array of tools and techniques being used to offset the limitations imposed by blindness.

NOTES: In notes 1, 4, 5, 6, 7, 8 and 9 below, the name of the item is followed by the APH catalog number.

(1) Handi-Cassette Recorder/Player 1-07080-00

(2) Recording for the Blind, 20 Roszell Road, Princeton, New Jersey 08540; (800) 221-4792

(3) National Library Service for the Blind and Physically Handicapped, 1291 Taylor Street, Northwest, Washington, DC 20542; (800) 424-9100

(4) AC/DC Rechargeable 4-Track Cassette Tape Recorder/Player (Model 3-5194) 1-07110-00

(5) Footpedal Switch 1-07020-00

(6) GE Remote On/Off Control Microphone 1-07160-00

(7) APH PocketBraille 1-07300-00

(8) External Memory Module 1-07302-00

(9) Cassette Tape Interface Device 1-07301-00

(10) Street Electronics Corporation, 6420 Via Real, Carpinteria, California 93013, (805) 684-4593

Augmentative Communication Alternatives for Persons with Disabilities

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Introduction

Augmentative communication refers to all communication that supplements speech. We all daily use augmentative communication techniques such as facial expressions, body gestures, writing. An individual whose speech is severely impaired must rely on an augmentative communication system that includes verbal and non-verbal language as well as communication technology.

Brief Overview of Prerequisites

Before a sophisticated, formal communication system can be used appropriately by an individual, certain prelinguistic skills must be present. These include sensory-motor and cognitive skills such as object permanence, means-end, cause-effect, yes/no, indicating preferences and choice-making. Other skills must also be present or developing such as eye contact, shared-referent, eye-tracking, and appropriate responses to auditory, tactile and visual stimulation. Symbolization skills should also be present or at least developing depending upon the level of the communication device or system being used.

Communication Access Modes (Selection Techniques)

The most desirable mode of communication is, of course, verbal speech. However, when this avenue of communication is not available or speech intelligibility is poor other modes must be considered. In general, other than sign language there are two options available for the non-speaking person. These options involve the use of direct selection or scanning techniques.

Direct Selection

Direct selection is a technique which can be used to indicate a response by directly pointing to it in some manner. Usually this is thought of as the most desirable and quickest means of communication next to speech.

Direct selection can be accomplished through touching, taking or pointing - all of which assume some useful range of motion. It can also be accomplished through head-, chin-, or mouth-pointers which assume some head control and through eye gaze which assumes head control and appropriate visual skills. Light pointers can also be used with an individual if either head or some hand control is present.

Scanning

Scanning is a technique which can be used with individuals who have limited motor control so that direct selection is neither accurate nor consistent. Scanning involves the selection of responses by moving a "cursor" through a series of choices and stopping the cursor on the desired choice. This can be accomplished through the activation of electronic switches positioned at the site which affords the most controlled and consistent movement. This is usually a much slower means of communication depending on the type of scanning and/or encoding technique used.

Types of scanning include linear--either visual or auditory, circular or rotary row-column, rowgroup-column (or step-scanning with branching), and directed scanning using a joystick. Appendix A includes diagrams which demonstrate these methods of scanning.

Coding Techniques

Coding techniques can be used with either direct selection or scanning and will have an effect on the speed of communication. They take into consideration the symbol system and the sequence of symbols that is used to convey the message. Messages can be either transparent or encoded.

Transparent

A transparent symbol system utilizes a one-to-one correspondence between the picture or symbol and the meaning and it can range from concrete to abstract. For example, using a concrete transparent code, a picture of an apple would convey the message "apple". Using an abstract transparent code, the written word a-p-p-l-e would convey the message "apple".

Encoding

Various encoding systems have been successfully used to increase the speed of communication with augmentative systems. Encoding is simply the combination of pictures or symbols through a pre-determined code to indicate the message intended. It allows the user to make fewer selections although he/she may be communicating longer messages. It can save space as well as time. Some successful encoding techniques include the following:

Semantic Compaction -- one symbol can be used to conceptualize a variety of meanings depending on the specific symbols and the sequence of selection.

Logical Letter Coding -- (or Abbreviation Expansion), one to three letters or letter/number combinations are used to store complete messages.

E-TRAN -- (Eye Transfer), messages can be coded by color, area, or letter sequences.

Morse Code -- series of dots and/or dashes represent letters or numbers and are combined to spell out messages.

Communication Devices

Communication devices currently in use can be divided into two categories depending on the level of technology utilized. Devices which use little or no technology are considered "low-tech" or "light-tech" systems and generally are characterized by a lack of voice or written output. Many can be constructed or assembled with readily available materials. Devices which use electronic technology are considered "high-tech" systems and generally include the use of voice output, possibly but not always written output, usually LCD (Liquid crystal) written display, and sometimes hard-copy.

Direct Selection Devices

Low-Tech devices here include (but are not limited to):

- Picture Communication or word board
- E-TRAN
- Canon Communicator

High-Tech devices here include (but are not limited to):

- Wolf
- AllTalk
- IntroTalker
- Macaw
- Parrott
- Sonoma Voice
- Memkey
- Power Pad
- Eye-Typer
- Unicorn
- TouchTalker
- LightTalker (with optical Head Pointer)
- ScanPac (with Light Pointer)
- IntexTalker/Say-It-All
- Vois Systems
- Light Writer/Talking Notebook/ Secretary/QED Scribe

Scanning Devices

Low-Tech devices here include (but are not limited to):

- Loop-tape message systems
- Choice boxes/compartments
- Clock Communicator or Dial Scan (Kanor, Don Johnston)
- Zygo 16 (Zygo)
- Versa-Scan (Prentke Romich Co.)

High-Tech devices here include (but are not limited to):

- ScanWolf
- Scanning Macaw
- Light Talker (with switch options)
- Scan Pac (with switch options)
- Computer interface (Words+, Cintex, Equalizer, WSKE, etc.)
- Scan Writer

All devices with identifying information are included in Appendix B.

Conclusion

With current state of the art advances in the field of technology a wide range of augmentative communication options are available for non-speaking individuals. However, due to the broad range of devices and systems available and the wide variety of individual difference in non-speaking persons, care should be taken to obtain a complete augmentative evaluation from a trained interdisciplinary team of professionals in order to match the appropriate device to the individual.

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Appendix B

Electronic Augmentative Communication Devices

Direct Selection

1. ALLTALK Adaptive Communication Systems, Inc. $2,995 - $3,995
   two sizes, user programmable, digitized speech output, membrane keyboard, 1 - 128 user-definable areas, 1 - 4 levels, design own overlays, cassette program storage, 600 - 1200 word memory, rechargeable batteries
2. CANON COMMUNICATOR Canon U.S.A., Inc. $395
   compact portable printer with strip tape output only, 95 character storage memory, rechargeable batteries
3. CATT (Computer Aided Talking Terminal) $595
   compact hand-held device with speech output, 15 keys with 10 levels for total of 126 messages, keyguard available, rechargeable batteries
4. INTEX TALKER Intex Micro Systems Corp. $2,495 - $2,645
   user programmable, voice output, membrane keyboard, 10 levels, speaks any message typed and has message memory from 8 - 1600 characters, program storage system, computer/printer interface available, rechargeable batteries
5. INTRO TALKER Prentke Romich Co. $795
   user programmable, digitized speech output, 32 - 1 1/2" keys, limited Minspeak ` system, 1 - 8 minutes of storage time (up to 120 words or 30 phrases).
6. LIGHTWRITER Zygo Industries, Inc. $5495
   dual visual display with speech output, roll tape printer, memory and word storage, rechargeable batteries
7. MACAW Zygo Industries, Inc. $995
   digitized speech output, 32 keys with key-link (enlarge keys or can be linked syntactically), rechargeable batteries.
8. PARROT Zygo Industries, Inc. $595
   small light-weight, 16 keys, digitized speech, designed for limited number of brief messages, rechargeable batteries
9. SAY-IT-ALL Innocomp $950 - $1350
   liquid crystal display (LCD), 618-846 user definable phrases, text-to-speech capability, male/female/child synthesized voice output, computer/printer interface available
10. SONOMA VOICE Sonoma State Hospital $375
    factory programmed user-specified vocabulary, 16 keys with 4 - 16 levels possible, 64 - 256 phrase capacity, synthesized male voice output, rechargeable batteries

11. SPECIAL FRIEND Shea Products, Inc. $3250

    LCD display, 26 levels, some factory programming with ability to compose or store messages, stored messaged are retrieved through a letter code system, has voice output, rechargeable batteries, has scanning capabilities

12. REALVOICE Adaptive Communication Systems, Inc. $2695

    LDC display, user programmable using LOLEC (logical letter coding) of 1 - 3 characters to recall messages of up to 250 characters each, may compose messages as well, uses computer keyboard (Epson), roll-tape printer encased in computer, voice output, memory capability of 23,000 characters, computer interface available, cassette program storage, rechargeable batteries

13. TIGER BOOK Tiger Communication Systems $75

    symbol book with bar codes using Magic Wand, voice output, 900 - 1100 word vocabulary, D cell batteries

14. TOUCH TALKER Prentke Romich Co. $3695

    LCD display, voice output, membrane keyboard with either 128, 32, or 8 keys, may compose messages or user-program approximately 1200 messages using semantic compaction (with Minspeak software), rechargeable batteries, computer/printer interface available

15. VOCAID Texas Instruments, Inc. $150

    membrane keyboard, voice output, 36 keys with preprogrammed vocabulary and overlays, D cell batteries

16. VOIS (130, 135, 136, 140, 150 series) Phonic Ear, Inc. $2995

    130 - voice output, membrane keyboard, some preprogrammed with capability to create, store, and edit up to 118 custom phrases containing a total of 3000 pieces of information, five levels with four pre-printed overlays and one blank, rechargeable batteries

    135 - voice output, four programmable levels, may group locations into larger areas, membrane keyboard, rechargeable batteries

    136 - voice output with ten user selectable voice pitches representing of 12,000 entries, selection areas are user definable, cassette storage system, rechargeable batteries

    140 - voice output, encoding system using three digit number combinations with a total of 3,000 character memory capacity, some information is factory programmed

    150 - encoding system using numeric membrane keyboard, voice output, three number combinations recall up to 1,000 pre-programmed information units or 100 custom messages, scanning capability

17. WOLF VOCAs (Voice Output Communication Aids)
Wayne County Intermediate School District $275 - 525
WOLF - housed in Texas Instrument Touch-n-Tell case, voice output, user specified factory programmed vocabulary of 500 words, 36 area membrane keyboard, areas can be combined, up to 30 levels, rechargeable batteries, user designed overlays

18. WORDS+ PORTABLE VOICE Words+, Inc. $1675
similar to ACS Speech PAC, separately powered voice synthesizer, has abbreviation expansion capabilities with letter/number codes, each code can hold up to ten characters, rechargeable batteries

19. EYE TYPER 300 Sentient Systems Technology, Inc. $3000
user programmable using eye gaze input, LCD display, voice output, may select either letters, numbers, or commands, computer/printer interface available

Scanning Devices

1. ICOMM Intex Micro Systems Corp. $2500
voice output, accepts single switch input, preprogrammed as well as custom vocabulary with a 2000 character memory, computer/printer interface available

2. LIGHT TALKER Prentke Romich Co. $4290
similar to Touch Talker, has same grid areas available, uses lamps rather than membrane keyboard, accepts input through single or multiple switches or can directly select through use of optical light pointer, automatic, row-column, or directed scanning

3. SCANNING MACAW Zygo Industries, Inc. $1495
same as direct selection Macaw, but with switch input capability

4. SCAN PAC/EVAL PAC Adaptive Communication Systems, Inc. $3695 - $3995
similar to Speech Pac, accepts single switch, joystick, dual switch, has morse code capability, LCD with printer, 112 programming positions, computer interface available

5. SCAN WOLF Wayne County Intermediate School District $375
similar to Wolf, accepts single switch input, auto or manual scanning, preprogrammed user specified vocabulary

6. SCAN WRITER Zygo Industries, Inc. $4000
LCD display, voice output, printer, row-column or directed scanning, single or multi-switch input, memory of 4000 characters which can be stored at 156 locations

7. SPELLER TELLER Al Kalashian $1325
clock-face dial scanner, accepts dual switch input, pre-selected vocabulary

8. ZYGO MODELS 16, 100 Zygo Industries, Inc. $900 - $1750
16 or 100 position scanning, auto or manual scanning, single or multi-switch input, adjustable speed, computer/printer interface available

Augmentative Communication Directory

Electronic Communication Device Vendors

1. Adaptive Communication Systems, Inc.
P.O. Box 12440
Pittsburgh, PA 15231
412-264-2288

2. Al Kalashian
3234 South Villa Circle
West Allis, WI 53227
414-327-4051

3. Canon U.S.A., Inc.
One Canon Plaza
Lake Success, NY 110429979

4. Innocomp
Innovative Computer Applications
33195 Wagon Wheel
Solon, OH 44139
216-248-6206

5. Intex Micro Systems Corp.
725 South Adams Road
Suite L8
Birmingham, MI 48011
313-540-7601

6. Phonic Ear, Inc.
250 Camino Alto
Mill Valley, CA 94941
415-383-4000

7. Prentke Romich Co.
1022 Heyl Road
Wooster, OH 44691
216-262-1984

8. Sentient Systems Technology, Inc.
5001 Baum Blvd.
Pittsburgh, PA 15213
412-682-0144

9. Shea Products, Inc.
1042 W. Hamlin Rd.
Rochester, MI 48063
313-656-2281

10. Sonoma State Hospital/
Development Center
Communication Engineering
P.O. Box 1493
Eldridge, CA 95431
707-938-6306

11. Texas Instruments, Inc.
Attention: Parts
P.O. Box 53
Lubbock, TX 79408
800-842-2737

12. Tiger Communication Systems
155 E. Broad Street #325
Rochester, NY 14604
716-454-5134

13. Wayne Co. Intermediate School
District
Attn: Greg Turner
33500 Van Born Road
Wayne, MI 48184
313-467-1415

14. Words+, Inc.
1125 Steward Court
Suite D
Sunnyvale, CA 94086
408-730-9588

15. Zygo Industries, Inc.
P.O. Box 1008
Portland, OR 92707
503-684-6006

16. F. Keep Company
22501 Mt. Eden Road
Saratoga, CA 95070
408-248-2579

Toy and Training Aid Vendors

1. Adaptive Communication Systems, Inc.
(See Device Vendors)

2. Al Kalashian
(See Device Vendors)

3. Crestwood Company
(See Switch Vendors)

4. Don Johnston Developmental
Equipment Company
(See Switch Vendors)

5. Handicapped Children's Technological
Services
(See Switch Vendors)

6. Radio Shack Stores
(one near you)

7. Steven Kanor, Ph.D. Inc.
(See Switch Vendors)

Types of Switches

Plate	arm slot	rocking lever	membrane plate
treadle	air cushion	tongue	mercury
pressure	grasp	eyebrow	mounting
pneumatic (sip & puff)	barrell	flex	vertical plate
pushbutton	bite	leaf	voice activated
joystick	chin	infrared/photo cell	pinch
wobble			

Adaptive Switch Vendors

1. AbleNet
   360 Hoover Street
   Minneapolis, MN 55413
   612-331-5958

2. Adaptive Communication Syst.
   (See Device Vendors)

3. Al Kalashian
   (See Device Vendors)

4. Asahel Engineering, Inc.
   N.E. 820 California Street
   Pullman, WA 99163
   509-332-2205

5. Crestwood Co.
   P.O. Box 04606
   Milwaukee, WI 53204
   414-351-0311

6. Don Johnston Developmental Equipment Company
   981 Winnetka Terrace
   Lake Zurich, IL 60047
   312-438-3476

7. DU-IT Control Systems Group, Inc.
   8765 Township Road #513
   Shreve, OH 44676
   216-567-2906

8. Handicapped Children's Technological Services
   P.O. Box 7
   Foster, RI 02825
   401-397-7666

9. Prentke Romich Co.
   (See Device Vendors)

10. Radio Shack Stores
    (one near you)

11. Steven Kanor, Ph.D., Inc.
    Toys for Special Children
    8 Main Street
    Hastings-on-Hudson, NY 10706
    914-478-0960

12. TASH, Inc.
    70 Gibson Drive
    Unit 1
    Markham, Ontario L3R 2Z3
    Canada
    416-475-2212

Are You Listening? Developing a Consumer-Responsive System

Rachel Wobschall
Minnesota Governor's Advisory Council on Technology for People with Disabilities

Minnesota begins with the assumption that all people regardless of severity of disability have the right to self determination and control of their lives. This paper will outline the ways in which Minnesota sought the input of individuals with disabilities, their families, and professionals to develop a consumer-responsive system of technology for people with disabilities.

There are three major criteria to measure needs in order to be consumer responsive:

1) Problem magnitude, or does an important and sizable problem exist?
2) Problem seriousness, or what are the possible consequences of not addressing the problem?
3) Assessment of current unmet needs, of existing resources, or are public and private resources sufficient to address the problem?

Problem Magnitude. We posed three questions in framing our needs assessment regarding problem magnitude:

1. What is the current size, intensity, and geographic distribution of the actual or anticipated problem that the technology program is designed to address?
2. What are the recent trends and future projections regarding the extent of the problem?
3. Are there any special concentrations of technology need based on age, socioeconomic status or urban/rural location?

Problem magnitude is a measurement of the size of the problem. However, attention must be paid to the various definitions of disability, technology, and the clustering of problems. Since there are few formal programs of technology, counting eligible people may be a premature method of needs assessment.

The Minnesota Governor's Advisory Council on Technology for People with Disabilities completed two statewide surveys and five statewide hearings between November 1988 and February 1989.

The first survey (see Figure 1) was conducted for the purpose of projecting general estimates about the size, intensity, and geographic distribution of interest in assistive technology, as well as to determine what kinds of devices and/or services are desired statewide. Months later a more detailed survey (see Figure 2) was designed to address very

specific needs of Minnesotans with disabilities regarding underserved needs. In addition to the surveys, the Governor's Advisory Council on Technology for People with Disabilities (hereinafter, the Council) held five public hearings throughout Minnesota. Participants included individuals with disabilities, parents, rehabilitation engineers, teachers, therapists, and other concerned citizens. In addition to the moving testimony of individuals with disabilities and family members, concerned providers were extremely beneficial in representing the needs of underserved populations that are unaware or to whom technological assistance is not available.

The first survey was sent out to 2,500 people and agencies as a supplement to the Governor's Planning Council on Developmental Disabilities monthly newsletter. Serving as a preliminary assessment of needs statewide, the survey showed that 100% of the respondents could benefit from the use of assistive technology devices.

Minnesota has a self-identified population of 600,000 individuals with disabilities which indicates a universal level of need. Of those who responded, less than 15% classified themselves as consumers and parents. However, 65% of the respondents classified themselves as educators, therapists, and case managers. The remaining 20% was made up of providers, administrators and professionals.

Projecting an estimated level of need of people with disabilities from our survey, providers indicated that 78% of the people with disabilities they currently serve use some form of assistive technology devices but that 34% of the individuals could benefit from more than one form of assistive technology. With respect to information dissemination, 64% of all respondents indicated more public information is needed even though these individuals had some basic levels of knowledge or information. In the area of training about one-half of the respondents, or their staff had participated in awareness activities about technology.

Problem Seriousness. The second major criterion of needs assessment is defined as problem seriousness. Problem seriousness refers to the social, economic, and human consequences that result if the problem is not addressed. In other words, to what extent is the problem a threat to the welfare of society? We posed two major questions in framing our needs assessment regarding problem seriousness:

1. What are the anticipated effects of not providing services? This question refers to the strength of the link between the problem - lack of technology - and more serious conditions such as not being able to communicate
2. Does the problem have more serious consequences for some groups than for others?

The primary method to gather information about problem seriousness was to listen to individuals with disabilities and their families. The Council held five public hearings in December, 1988, and January, 1989. Each hearing was hosted by representatives of the

Council from that region of the state. Testimony was gathered to determine the seriousness of the problem and how to overcome barriers confronting people with disabilities as they try to access assistive technology for use in daily activities.

Notification and recruitment for the meetings occurred in the following ways.

1. The Council sent press releases to 75 local television stations and newspapers statewide.
2. The Council proceeded to send notices, and make follow-up telephone calls, to more than 1,000 disability advocacy organizations and agencies outside the Twin Cities metropolitan area to encourage individuals to attend.
3. The Council encouraged the advocacy organizations to place a notice in their respective newsletters of the hearings. Over 150 people from across the State attended the hearings which were held in the northeast, southeast, west central, northwest, and metropolitan area. The hearings gave the Council an opportunity to hear firsthand the needs and the recommendations of people with disabilities, parents, educators, therapists, and case managers.

The needs the participants shared with the Council were in the following areas:

Funding in the areas of affordability of devices and services, the need for increased technological developments and adaptation of existing equipment.

Improved delivery systems including increased access to technology outside of the Twin Cities metropolitan area.

Increased assistive technology use in the areas of technologies that enhance community integration and augmentative communication.

Educational use to help students with disabilities expand their learning power. As one parent of a child with disabilities stated, "We must recognize the importance of technology to facilitating independence and integration for individuals who have disabilities and for their families."

Technology's role in the lives of people with disabilities is essential. In addition to the computer, there are simple switches, remote controls, voice synthesizers, and touch pads. The list is endless. Each tool or device increases the independence of people with disabilities, and allows them to lead a fuller, more productive life.

The following is a sample of recommendations from those people who presented testimony at the hearings.

Funding. Current state and federal policies, along with the advent of newer, more expensive high technology, creates serious backlogs for the approval and subsequent delivery of assistive technology.

> "The biggest barriers I have encountered are availability and funding. I have been waiting for a Min-Speak communication system for a long time [over two years], and MA (Medical Assistance) has taken a very long time to approve items. I could benefit [emotionally and physically] from having a computer, doing major renovations to my living arrangements - but where is the money?" - Person with disabilities, St. Louis Park, MN.

> "There is a need for funding to develop technology to aid in developing/improving expressive communication for people who have become aphasic... there is also a great need for increased funding for staff for rural interpreter training programs...this need is common for all areas but is worst in rural areas." -Deaf Services employee, Willmar, MN.

Concerns were also raised regarding Minnesota's Medicaid program coverage - Medical Assistance:

> Why can't more flexible options be made for the disabled in terms of users' needs, health, life-style, etc. as to what type of wheelchair Medical Assistance will allow the disabled to acquire?" -Person with disabilities, Rochester, MN.

Delivery System. What is true in the funding arena, is also true in technology delivery. There exists no cohesive statewide plan for the delivery of equipment to people with disabilities, especially in rural regions outside the Twin Cities. More regional delivery would be beneficial, with qualified support staff to make visits to people who would not be able to use centers in the metropolitan area. Mobility and versatility in this area are of major importance.

> "If a statewide delivery system were present, it would be easier for persons with disabilities to be made aware of the technology that is available to make their lives easier, as well as providing the resources necessary to make it a reality." -Speech-Language Pathologist, Monticello, MN.

> "There is a need for equitable access to devices and technical support in all geographic areas... regional services centers, (with) shared staff among school districts...TTY networking system to increase involvement." -Project Consultant, St. Paul, MN.

> "Suggestions for (technology) availability: 1) accessibility throughout geographic areas of the state; 2) resource centers; 3) technology fairs to

demonstrate new technologies and adaptations; and 4) networks for independent living, new adaptive devices, and sharing technologies." -Parent of a child with disabilities, Center City, MN.

Information Dissemination. The need for information dissemination is considered by many to be the most important need in the area of technology for people with disabilities. Without a coherent awareness effort, people cannot and do not gain an understanding of what is available to them, and thus cannot use the technology to their advantage.

"Could the Governor's Advisory Council establish a 'technology bank' where all of this information could be available in printed form, or over a computer? A 'telephone bank,' available during working hours, to all rehabilitation personnel in the State, to answer specific questions about technological adaptation and to educate on the process of how to acquire such equipment would be extremely beneficial." -Employment Specialist, Minneapolis, MN.

"...(A) clearinghouse is needed for making assistive technology decisions. This clearinghouse should provide information on assessment, funding and on-going support for the user." -Case Manager, St. Paul, MN.

"I also believe there should be a clearinghouse for both used and an up-to-date register on the rapidly-changing world of software and its availability. I would also like to see an instruction period on how to properly use the technology and some one-to-one contact on setting it up, and someone who could be easily contacted for repair or support of the device." -Person with disabilities, St. Paul, MN.

Communication and Community Integration. People with disabilities expressed the need for assistive technology for better communication and community integration. By increasing the availability of electronic augmentative voice-output communication systems one's ability to interact an the community is enhanced.

"Technology can only be used in conjunction with human factors. More importantly, such technology for communication devices can only be utilized in a society that encourages people to take the time to listen to the voice of the disabled person." -Person with disabilities, Winona, MN.

"Remote control has (the) potential to be of great service for people whose disabilities affect their manual dexterity due to paralysis or diseases." -Person with disabilities, Minneapolis, MN.

"Technology has made it possible for us to express our ideas and feelings and let you discover that we do have things to say. Computer technology is one of the most important keys in making a person with a disability become more productive and independent." -Person with disabilities, Minneapolis, MN.

Education. The need for technology-related assistance was also mentioned for educational purposes. The provision of assistive learning devices in elementary school can enhance the future academic performance of a child with disabilities. Providing technology early enough to children in school can have a positive effect in their lives.

"(My) main point of concern is continued support of technology to public schools as technology changes and individual needs are identified in future, that we may adequately provide communication devices for the people who have the cognitive abilities to use them and devices for the people who can enhance their daily living skills toward greater independence." -Communication Disorders Specialist, St. Cloud, MN.

"Very few (people with disabilities) have any library skills. They would need to know basic things such as how to behave in a library, what area of the library to go to, and how to ask for help. This could be done through volunteer groups or through students majoring in special education." -Parent of a child with disabilities, Grand Marais, MN.

"I have seen students who use technology demonstrate more mastery over their environment and thus give access to a world otherwise unknown. I believe it is our duty to use technology to maximize an individual's potential." -Occupational Therapist, St. Peter, MN.

One exceptional piece of testimony was presented by a young woman who is legally blind and in her first year of college. She explained how she had enjoyed high school because she had access to assistive technology devices for persons who are visually impaired. Upon graduation she was anticipating expanding her horizons at the University of Minnesota. When she began fall quarter she was disappointed with what she found: the University did not have

sufficient access to assistive technology devices or services to allow her to participate in the learning process as fully as she had in high school. This is an excellent example of how we must strive for the provision of assistive technology devices and services in education at every level in the state of Minnesota.

The preliminary assessment indicates the problem of access to technology is a major problem and has serious consequences.

Assessment of Current Unmet Needs. Individuals with disabilities and families are the best sources of information regarding unmet needs. Even more important is the role these individuals played in the development of this federal grant application and in the proposed implementation of the statewide program.

A statewide survey was distributed to be completed only by individuals with disabilities. The goal of this second survey was to gather information directly from individuals to design a statewide program to meet the needs of people with disabilities. If the individual with a disability was unable to complete the survey, the survey was to be completed by a person who could best represent the interest of the consumer. The survey consisted of five sections:

1. The person's unique needs regarding assistive devices and services
2. How people are currently meeting these needs
3. How people receive information
4. Where people purchase technology devices and services
5. How they paid for devices and services.

Surveys were distributed to 2,500 people with disabilities through mailing to all 435 public school districts, 200 clients of the Division of Rehabilitation Services, and more than 1,000 organizations of and for people with disabilities from the State Council on Disability mailing list. Every group was encouraged to make additional copies to distribute to as many people as possible. There was a special effort to notify the northern and western areas of the State of the survey. According to our knowledge of the location of consumer advocacy organizations, these areas are underrepresented.

The responses of the individuals were used to help the Council develop its goals and objectives as well as document its unmet needs. These surveys as well as the public hearings help to identify the major unmet needs in Minnesota.

Awareness of the needs of individuals with disabilities for assistive technology devices and assistive technology services.

Need	Assessment
Obtaining assistive technology devices	Of the 364 respondents 41% indicated they did not know where to obtain assistive

	technology devices.
Obtain training or course instruction about assistive devices	Of the 361 respondents, 80% of the people indicated they had not attended any training sessions.
Increased understanding of assistive technology devices and what they can do for an individual with disabilities	On a scale from 1-5 (1=not at all, 5=a great deal), 61% had a level of understanding of 3 or below which included no slight, disabilities, or somewhat understanding. A total of 349 responded to this question.
A basic need of acquiring assistive technology to improve the quality of life for people with disabilities	When asked why they were not presently using assistive technology devices, 45% of the 138 respondents indicated not knowing where to locate them, how to adapt them to their needs, and lack of available training and support.

These results imply that individuals with disabilities do not know what is possible. There is a dramatic need to increase their awareness about the availability of, the proper training of, and understanding of assistive technology devices. The vast majority of respondents have not attended any training sessions and have slight understanding of technology. While several sources of information exist in Minnesota, the majority of individuals do not know where to obtain devices or how to adapt them.

Increase the awareness of policies, practices, and procedures that facilitate or impede the availability or provision of assistive technology devices and services.

Need	**Assessment**
Proper insurance coverage	Of the 311 people who have insurance, 47% are on either Medical Assistance or another form of insurance. Five percent of the respondents do not have insurance.
Increased employability among people with disabilities	The unemployment rate of the respondents revealed that 67% do not have a job.
Increase in the earning power of individuals with disabilities	When we inquired about income, 67% of the people answered that they earn less than $15,000 per year.

The data obtained in this section, unfortunately, depict policies, practices, and procedures that impede the provision of assistive technology devices and services to individuals with disabilities. Medical Assistance is widely regarded as an ineffective method of

financing assistive technology. Many services under the Medical Assistance program must have prior authorization procedures, and only if assistive technology is a "medical necessity" will it be covered. As a result, many individuals with disabilities who are on Medical Assistance cannot obtain assistive technology and services. An additional concern is those people who do not have any insurance at all.

There is a need to increase the awareness of employers about assistive technology to allow them to take full advantage of the skills and abilities of people with disabilities in the work place. Furthermore, employers need to be educated on the facts and myths about people with disabilities. Many people added comments to the survey that they have problems finding a job; and if they found an opening, they had trouble securing the job. They indicated this was due to the misperceptions employers had about the ability and competence of people with disabilities.

Along with the high unemployment rate of individuals with disabilities is the lack of earning power. Inherent in this argument is the fact that as individuals with disabilities earn money, they could be able to buy the needed devices and/or services needed. With a salary, they could be active consumers of assistive technology and have a voice in the marketplace.

Increase the availability of and funding for the provision of assistive technology devices and assitive technology services for individuals with disabilities.

Need	Assessment
The ability to obtain assistive technology devices	The percentage of respondents (N=138) who are not using assistive technology devices because of cost is 85%.
Increased employability and the earning power of people with disabilities	67% of the respondents do not have a job and 67% earn less than $15,000 per year.
Obtaining assistive technology devices	Of the respondents, 41% indicated they did not know where to obtain assistive technology devices.
Insurance coverage	Of those people that have insurance, 47% are on either Medical Assistance or another form of insurance.

To increase the affordability of assistive technology devices and services there must be a way to increase the provision of funding for people with disabilities. The Medical Assistance program needs a mechanism to facilitate the process by which to secure funding, as well as expedient prior authorization practices. Respondents also indicated that they do not have the assistive technology they need because of the "red tape" involved with Medical Assistance. A

more unfortunate reason is that some do not even bother securing help from public financing because it takes too much time.

Increase the awareness and knowledge of the efficacy of assistive technology devices and services among individuals with disabilities, their families and any/everyone who is involved with people with disabilities.

Need	**Assessment**
Training about and use of assistive technology devices	80% of the 36% respondents mentioned they have not had training on assistive technology devices
Increased understanding of the benefits assistive technology devices can bring to the life of a person with a disability	On a rating scale from 1-5 (1-not at all, 5=a great deal), 61% had a level of understanding of 3 or below.
Increased information dissemination	Respondents indicated using the following sources:
Increase employability and the earning power of people with disabilities	67% of the 362 respondents do not have a job and earn less than $15,000 annually.

Source	Number
conferences	27
magazines	40
television	26
therapists	6
prof. journals,	5
other	95

People with disabilities must be made aware of the kinds of technology that are available to assist them. Perhaps once they understand the benefits technology can bring to their lives, there will be greater receptivity to its use.

Another factor that could affect the awareness of assistive technology in the life of a person with a disability is employment. Wage is a factor in affordability but also awareness of employers about the benefits of assistive technology. Training programs for businesses could help employers focus beyond the exterior of a person with a disability to their skills, capacities, and strengths. Employers need to be educated that assistive technology can help the employee achieve a greater level of efficiency in the work place.

Increase the capacity of public and private entities to provide technology-related assistance, particularly assistive technology devices and services, and to pay for the provision of assistive technology devices and services.

Need	Assessment
Increase training	80% of the respondents have not attended training classes.
Obtaining assistive technology devices	Of the respondents, 41% indicated they did not know where to obtain devices.

Increased assistance to obtain needed Of those people that funding from private and public have insurance, 47% are resources on either Medical Assistance or another form of insurance.

Public and private entities through interagency agreements can provide some training programs.

Coordination among state agencies, public and private entities that provide technology-related assistance.

Although the survey form did not provide direct questions regarding the unmet needs of individuals and families related to state agency coordination, the respondents volunteered many additional comments about this topic:

"It's time to combine resources to develop quality services."

"We need creative, flexible services that respond to our needs."

"We need to have standard formats for individual planning."

"Money does not follow people across settings."

"Need more coordination of programs."

"If we want to forge new paths to fit the needs of individuals, then open the doors of restrictive policies."

"We need more cooperation among agencies in this area and more innovation."

"We believe that there is a great need for agreements among the players."

"There is need for consistency between agencies."

"We should be able to skate from one part of life to another, from one program to another; but it is not easy. It is awkward."

"What happens when my son graduates from school? Will there be accessible programs?"

"Insurance is a nightmare."

"Trying to get needed equipment is very difficult."

These statements are indicative of how an uncoordinated system of technology services fails to assist individuals with disabilities and families receive necessary services and supports.

A lack of coordination results in inefficiency, frustration, and anger by people with disabilities and families as they try to have needs met.

Increase the probability that individuals of all ages with disabilities will, to the extent appropriate, be able to secure and maintain possession of assistive technology devices as they make the transition between services offered by Human Service agencies or between settings of daily living.

Need	Assessment
Obtaining assistive technology devices in making transitions in in daily living	Of the 364 respondents over 40% indicated problems in making transitions with the assistive technology devices.
Secure and maintain devices as they make transitions between residential settings	The respondents lived in a wide range of settings. Approximately one-third of the individuals lived independently. The remainder lived with families or in restrictive settings.
Secure devices to enable successful employment	Two-thirds of the are unemployed.

As indicated in the coordination section, respondents are very concerned about the difficulty in receiving services across programs and age groups. Individual planning is not coordinated between agencies; funding is not coordinated; and policies are restrictive. The survey respondents indicated many problems in making transitions with assistive technology devices. Another indication of unmet need is the transition of individuals from restrictive residential settings to integrated settings with necessary supports. Technology is extremely important as an additional support for independent living. Finally, the transition from unemployment to employment requires the use of assistive technological devices to provide reasonable accommodations and necessary assistance on the job.

The information gathered from these sources provided the basis of our S.T.A.R. (A System of Technology to Achieve Results) project; a three-year plan of activities that addresses public education, public policy, funding, delivery, coordination and lifespan issues that were raised by persons with disabilities.

Minnesota enacted legislation that created a statewide initiative which can be used as a model for other states. A sample of this initiative is denoted as Figure 3.

Figure 1

Needs Assessment Survey
Technology for People with Disabilities

The Governor's Advisory Council on Technology for People with Disabilities is requesting your assistance. Please complete and mail this questionnaire *by December 1, 1988.* This needs assessment survey will be used in preparing a proposal for a federal grant under the new federal Technology-Related Assistance for Individuals with Disabilities Act of 1988. Minnesota will be competing with other states for a grant from OSERS.

Definitions:

Assistive Technology Devices - means any item, piece or equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities. Examples of assistive technology devices would include such items as: computer access equipment, switches, positioning and mobility devices, or augmentative communication devices.

Assistive Technology Service - means any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device. Examples include: 1) evaluation of the needs of an individual; 2) purchasing, leasing, or facilitating the acquisition of assistive technology devices; 3) designing or customizing devices; or 4) coordinating such services.

Name_____

Agency_____

Address_____

Telephone_____

1. What types of disabilities apply to you, your clients, or your family members?

_____Visual impairment
_____Physical disability
_____Hearing impairment
_____Mental retardation
_____(Specify):_____
_____Speech impairment
_____Emotional impairment
_____Learning disability
_____Other

2. In what ways are you involved with persons with disabilities?

_____Consumer
_____Educator
_____Parent
_____Case Manager
_____Therapist/practitioner
_____Other (Specify)
_____

3. If you represent an agency or organization, how many people with disabilities are served each year? _____

4. Could you, your family member, or the people you serve benefit from the use of assistive technology devices? _____Yes _____No
   If "yes", and if you represent an agency of organization, how many people with disabilities that you serve could benefit from the use of assistive technology devices?
   _____

5. Do you, your family members, or people with disabilities you serve currently use assistive technology devices and related services? _____Yes _____No

6. Do you know where to obtain information on assistive devices and services?
   _____Yes _____No

7. Have you or your staff participated in any type of awareness activities (*e.g.*, training) regarding assistive technology devices? _____Yes _____No

8. Please describe any additional needs you have relating to assistive technology devices and services (*e.g.*, funding, equipment demonstration, training, *etc.*).

Thank you for your assistance
Please fold, Apply stamp, and Send to address Below

Governor's Advisory Council on Technology and Disability
Department of Trade and Economic Development
900 American Center Building
150 East Kellogg Boulevard
St. Paul, Minnesota 55101

Figure 2

Needs Assessment Survey Technology for People With Disabilities

We are seeking your input. Please help us design a program to meet your needs

This survey is intended for individuals with disabilities. If you are helping someone fill out this survey please be sure that the questions are answered as if the person was filling out the survey survey themselves. Please return the survey by 2/28/89.

1. Do you know where to obtain information on on assistive devices and services?

☐ Yes
☐ No

Assistive Devices: Any item, piece, of equipment, or product system, whether acquired commercially, off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of an individual with disabilities. Examples include: wheelchairs, switches, computer access equipment, positioning and mobility aids, and augmentative communication devices.

1a. If Yes where?

2. Have you gone to any training or classes about assistive devices?

☐ Yes
☐ No

2a. If Yes what, where and when?

3. Do you feel that you understand assistive devices and what they can do for you?

☐ A great deal ☐ Slightly
☐ Quite a bit ☐ Not at all
☐ Sometimes

4. Where did you obtain your understanding of assistive devices and what they can do for you?

- ☐ Magazines
- ☐ Conferences
- ☐ Television
- ☐ Other
- ☐ Professional Journals

5a. Are you aware of any assistive devices that would help you be more self sufficient, that you do not have?

- ☐ Yes
- ☐ No

5b. If Yes, please describe or name the assistive devices.

Attach a separate sheet if necessary

5c. If Yes, why aren't you using the assistive devices you listed above? (Check all that apply.)

- ☐ Cost
- ☐ Not sure how to adapt to your needs
- ☐ Not sure where to locate it
- ☐ Not sure that it would really work
- ☐ Availability of training and support
- ☐ Other _____

6. What are your current living arrangements?

- ☐ With family
- ☐ Semi independent
- ☐ Independent
- ☐ Group Home
- ☐ Other _____

7. What country do you live in?

8. Please describe the limitations your disability or disabilities places on your ability to function effectively in society.

☐ Mobility ☐ Communication
☐ Employment ☐ Other

Attach a separate sheet if necessary

9. What is the underlying cause of your disability? (For example: Cerebral Palsy, Heart Disease, Spinal Cord Injury, etc.)

Attach a separate sheet if necessary

10. Who provides your health care coverage? (Check all that apply.)

☐ MA/Medicaid ☐ Medicare
☐ Private Insurance ☐ Veterans Benefits
☐ SSI/SSDI ☐ Other _____

11. Please describe any additional needs you have relating to assistive devices and related services. (funding, training, equipment demonstrations, etc.)

Attach a separate sheet if necessary

12. Are you employed?

☐ Yes ☐ No

The following information is Optional and is sought only for the purpose of com;iling a report to grant makers.

13. How old are you?

_____ Years

14. What is youe income before taxes? (Please include ann sources.) your ability to function effectively in society.

- ☐ $0-$4,999
- ☐ $5,000-$9,999
- ☐ $10,000-$14,999
- ☐ $15,000-$19,999
- ☐ $20,000-$24,000
- ☐ $25,000-$29,999
- ☐ $30,000-$34,999
- ☐ $35,000-$39,999
- ☐ $40,000-$49,999
- ☐ More than $50,000

15.

Sex

- ☐ Male
- ☐ Female

Race/National Origin

- ☐ Native American
- ☐ Asian
- ☐ Caucasian
- ☐ Black
- ☐ Hispanic
- ☐ Other _____

Optional if you would like to be on our mailing list
(will not be traceable to your answers)

Name: _____

Address: _____

_____

Phone Number _____

Please return your response to:

Governor's Advisory Council on Technology for People with Disabilities
900 American Center Building
150 East Kellogg Boulevard
St. Paul, Minnesota 55101-1421

Figure 3
Sample Legislation to Create a Statewide Technology Initiative

Section 186.

Amended by adding a subdivision to read:

Subdivision 5a. [Technology for People with Disabilities.] The council has the following duties related to technology for people with disabilities.

1. to identify individuals with disabilities, including individuals from underserved groups who reside in the state and conduct an ongoing evaluation of their needs for technology-related assistance;
2. to identify and coordinate state policies, resources, and services relating to the provision of assistive technology devices and assistive technology services to individuals with disabilities, including entering into interagency agreements;
3. to provide assistive technology devices and assistive technology services to individuals with disabilities and payment for the provision of assistive technology devices and assistive technology services;
4. to disseminate information relating to technology-related assistance and sources of funding for assistive technology devices and assistive technology services to individuals with disabilities, the families or representatives of individuals with disabilities, individuals who work for public agencies, and private entities that have contact with individuals with disabilities, including insurers, employers, and other appropriate individuals;
5. to provide training and technical assistance relating to assistive technology devices and assistive technology services to individuals with disabilities, the families of representatives of individuals with disabilities, the families or representatives of individuals with disabilities, individuals who work for public agencies, and private entities that have contact with individuals with disabilities, including insurers, employers, and other appropriate individuals;
6. efficacy and availability of assistive technology devices and assistive technology services for individuals with disabilities;
7. to assist statewide and community-based organizations or systems that provide assistive technology services to individuals with disabilities;

8. to support the establishment or continuation of partnerships and cooperative initiative between the public sector and the private sector;
9. to develop standards, or where appropriate, apply existing standards to ensure the availability of qualified personnel for assistive technology devices;
10. to compile and evaluate appropriate data relating to the program, and
11. to establish procedures providing for the active involvement of individuals with disabilities, the families or representatives of the individuals, and other appropriate individuals in the development and implementation of the program, and for individuals with disabilities who use assistive technology devices and assistive technology services, for their active involvement, to the maximum extent appropriate in decisions relating to the assistive technology devices and assistive technology services.

Section 187. [Transfer.]

The council on technology for people with disabilities, created by executive order number 86-12, is transferred to the council on disability. Minnesota Statutes, section 15.039, applies to this transfer.

NASA and the Process of Technology Transfer : Current Involvement and Implications for the Future

Ismail Akbay

Technology Utilization Office

NASA Marshall Space Flight Center

Introduction

It is a great pleasure to be with you-- here in the great state of Arkansas -- and to meet with people interested in the improvement of technology and, generally, in reaching out today for tomorrow's knowledge. I want to start off by wishing the best of success to the "Technology Access for Arkansas" organization. If I can contribute in some small way to increasing your knowledge and expertise, then I will have accomplished my mission, which is to help make American technology, in Arkansas and all across our nation, the best and most advanced in the world.

As many of you are aware, this year, 1989, is the year of Apollo, the 20th Anniversary of one of the world's greatest technological accomplishments ... the first landing of man on another heavenly body... the moon.

When Neil Armstrong put the first human footprint on the lunar surface, it was an act which ended a decade of giant technological leaps. Pulling off that feat required unprecedented leaps in the technology all across the board.

During the decade of the sixties, Nasa put together a national team composed of government, industry and the educational community. That team broke the technical barriers and produced the hardware and the systems capable of journeying great distances from the earth.

There were thousands of technology spinoffs from the Saturn/Apollo program. We are still reaping the benefits of new ideas and inventions born during those years.

In addition to new technical ideas, Americans benefited from something else, something intangible, and perhaps far greater than technology. And that was, very simply, the knowledge that they were capable of pulling off such a feat. It was best stated by one of the pioneers of the Space Age, Dr. Wernher Von Braun, who was director of the Marshall Space Flight Center and a man of vision. In July of 1969, on the night before the launch of the first moon landing, he said:

"I want to offer my gratitude to ... all Americans who have created the energetic society that has made possible mankind's reach into space."

Is our society still an energetic society? Perhaps it's time to take another look at the American Spirit ... and to think about rekindling and building the fire again within ourselves.

We can be the best in educating our youth, exploring new frontiers, in doing things better and more efficiently. We are the nation, the people and the economy with the strength to build the space shuttle and the vision to plan a large, permanent space station in Earth orbit. We are looking forward to new frontiers, new missions to the Moon and planet Mars. We are the nation with the will and the knowledge to be world leaders ... to be the best.

As the 21st Century draws near, it becomes clearer that success on Earth will come to the nation with the energy to lead in the exploration and utilization of the new space environment. I believe that the quest for knowledge and excellence in space can fuel the American dream ... that it can inspire American youth to want to excel and to succeed ... and to look with confidence and excitement toward the future.

So, believe it or not, one of the major fallouts, or spinoffs, from NASA's space program is not something you can hold in your hand. It is, rather, a rejuvenation of the spirit and energy of the people which made this nation great.

President Bush, In a Major space policy speech last July, on the twentieth anniversary of the landing of the first man on the moon, recognized the importance of space exploration. He proposed a long-range, continuing and permanent commitment. He said that while Apollo was a great beginning, our nation should continue to look outward toward new worlds. His words were: " Our goal is nothing less than to establish the United States as the preeminent space faring nation."

He strongly urged that we commit to the following:

--Space Station Freedom should be our critical next step in space, for the 1990's.

--Early on in the new 21st. Century, we should go back to the Moon. And this time to stay.

--And third, he proposed a " journey into tomorrow -- a journey to another planet -- a manned mission to Mars."

A continuing space program means a continuing fallout and spinoff of new ideas from NASA. Let's look at a bit of history of NASA fallout, and that will let us see what we have to look forward to in our space future. For about 13 years the NASA Technology Utilization Office has published an annual spinoff report. These reports, published in magazine style, provide information about NASA space projects as well as providing some detail about spinoff items.

Early this year, the Chapman Research Group, Located in Colorado, Completed a Study to explore the "real Benefits" from the spinoffs listed in the publications.

The study looked at 441 separate instances of the application of NASA-sponsored or provided technology. Of this total:

--368 company officials acknowledged increased savings or sales.

--109 of the cases where savings was acknowledged either could not estimate savings or would not because of the proprietary nature of the information.

--Of the 259 cases where respondents were able to identify sales or savings, the contributions to sales totaled $21.3 billion and to savings, $315.7 million. (See Table 1)

It is important here to emphasize that the samples studied do not include even all the "good" examples of spinoff known to exist. And these examples exclude NASA Commercialization programs; mission-directed applications such as weather satellites, communications satellites and the like; and social benefits such as lives saved, lengthened or improved; environmental improvements; productivity improvements and others.

And, a look at the categories into which the above spinoffs were placed is interesting. The industrial manufacturing area, of course, is the leader in the number of cases. But the sales and savings benefits leader is "transportation" due in large to the spinoff from NASA aeronautics studies to the aviation industry. The medical category is second in number of cases but third in the money column.

Estimated annual average revenue in federal corporate income taxes derived from the listed cases is $2.3 billion. Public agency and university sales were excluded.

It should be mentioned again that this study involved only a small "tip of the iceberg" portion of the benefits from the space program and involves only those instances where tangible and real sales and savings benefits could be provided.

How Can NASA Help?

The NASA Technology Utilization Program is an outreach program open equally to Arkansans and all Americans. We urge you to make contact with any of the various parts of the network.

--We want to hear from you if you have a problem in your plant or business which might use NASA assistance. We include problems in production, materials, structures, power supply, computer software and many, many other areas.

--We want to hear from you if you have an idea you wish to explore and your idea needs new technology. A warning here, however, that most of our assistance must go into the public domain.

--We want to hear from you if there is an area where you need to become more efficient to meet the demands of the world market.

--If there is any doubt whether or not we can be of assistance, please call or write and find out.

How to Contact the NASA Technology Transfer Network

The NASA Technology Transfer Network is extensive and is as near to you as your post office or telephone. Brochures outlining the network and providing addresses and telephone numbers will be made available to you. The Following are the major organizations which will assist you:

Technology Utilization Offices. Each NASA Center has a Technology Utilization Office where technology applications specialists will listen to you and provide assistance.

NASA Scientific and Technical Information Facility. Located in Maryland, this NASA supported organization provides general information and assistance and has applications for the NASA *Tech Briefs* publication. The *Tech Briefs* magazine is free to qualified business and industrial persons and monthly provides the most up-to-date and easily obtained listing of NASA new technology.

Industrial Applications Centers. There is an extensive network of about 40 industrial applications centers and affiliates located all across the country. These centers usually charge a minimal user fee and offer a sophisticated technology transfer service dedicated to finding fast answers in today's competitive climate.

Technology Applications Centers. Public organizations that face problems in such areas as safety, health, manufacturing or environmental protection can request assistance from a technology applications team by contacting a NASA Field Center Technology Utilization Office.

Computer Software Management and Information Center (*COSMIC*). *COSMIC* gives you access to thousands of computer programs at reasonable cost. Programs are available on a wide range of subjects. *COSMIC* will perform a search for you at no cost.

NASA Patents and Inventions. NASA ideas and inventions are available for licensing on an exclusive or nonexclusive basis. Please contact a NASA Field Center Technology Utilization Office or Patent Counsel for additional information.

Federal Laboratory Consortium. The NASA field centers are all members of the Federal Laboratory Consortium (FLC). Arkansas is in the Midcontinent Region which has headquarters located at Sandia National Laboratories, Albuquerque, New Mexico, [Phone:(505) 844-5535]. The FLC was created following the Federal Technology Transfer Act of 1986 under which federal labs were mandated to transfer technology to state and local governments and the private sector. The NASA network was in place prior to the 1986 act.

The Chapman study, which reviewed 441 case instances of the application of NASA-derived technology, provided helpful suggestions for industrialists or technical directors looking for technical assistance

First thought is to "keep an open mind." In exploring new technology from NASA, other potential uses may unfold. The full range of results are not always predictable and one should be prepared to take advantage of unexpected opportunities.

Second, "problem solving is the ideal context". A successful transfer is most often accomplished within this situation.

Third, "commercialism is a long, complicated process". Innovation often is killed by impatience before it reaches maturity. Do *not* focus always on short-term results.

The Chapman report divided the spinoffs it studied into nine categories (see Table 1). The medical category, which is dearest to the hearts of many Americans, had the second largest number of cases, a considerable array of benefits. Improved diagnosis and treatment is noted which improves patient comfort and facilitates a more normal life. These are benefits to which monetary terms are not easily attached. There has been an explosion in medical use of such computer technology as digital-imaging techniques. Microminiaturization, where NASA has pioneered, has been especially adaptable to medical needs.

Even now, at the Marshall Center in Huntsville, we have a project underway to improve the end-effectors available for below-elbow amputees. This one is a human interest story. The project developed when a retired Marshall engineer lost his hand in his home workshop. His friends at the center joined in a project to improve the prosthetic devices available to him. They have investigated simplified devices which allow the amputee to operate a fishing reel, a chainsaw and perform other activities. Investigations of the potential for patent applications are underway.

The prosthetics project started with the engineer's dissatisfaction with the hook for which he was fitted after his accident. He enjoys hunting, fishing, working in his shop and other activities and the hook was not allowing a sufficient level of activity. So he went to work on his own ideas, helped by Marshall Center personnel through the Technology Utilization Office.

As in all other such projects, the inventions resulting from this NASA study will be available to the private sector for licensing.

The Prosthetics project is just one example of technology transfer activities in NASA. As I said at the beginning, NASA's goal is to help make American technology the best and most advanced in the world. Obviously, we are a bureaucracy, a government agency, and it's not always an easy and quick process to get something accomplished. Be patient with us, but please make the effort. Call me personally at the Marshall Space Flight Center; my number is listed in the brochure we are handing out. Keeping up with technological advances is just as important in Arkansas as it is in Detroit or Los Angeles or any of the industrial centers of our

nation. We won't always be able to help you, but, if there is a research effort underway that matches your need, we will investigate and assist you in every way possible.

I would like to emphasize again that we Americans should rekindle our national resolve. We are the society with the resources, the ability and the spirit to place our citizens on the surface of another heavenly body, the Moon. We are now looking forward to assembling a large Space Station in low Earth orbit and looking toward sending humans to the Planet Mars and to permanent stations on the Moon.

Let's be the best, in every way we can.

Table 1

Benefits Realized From NASA-Furnished Technology Case Applications from *Spinoff* Reports by Categories of End Use Sales and Savings, $(000)*

End Use Description	*N* of Cases	*N* of Cases with Sales/ Savings	Benefits Sales($)	Realized Savings($)	Total($)
Communi-cation/Data Processing	51	32.	171,007	51,964	222,971
Energy	30	13	203,500	15,613	219,113
Industrial (Mgf.& Processing)	170	107	105,767,649	67,837	5,835,486
Medical	61	31	2,003,036	30,613	2,033,649
Consumer Products	24	18	1,278,294	524	1,278,818
Public Safety	27	16	347,888	555	348,443
Transporta-ion	40	18	9,887,865	116,623	10,004,488
Environ-mental	16	11	16,962	21,788	38,750
Other	22	13	1,654,989	10,232	1,665,221
Total	441	259	21,331,190	315,749	21,646,939

*Estimates were obtained from company officials, or derived from company estimates of manpower or other types of savings. The 441 cases were reported in *Spinoff* magazine, 1978-1986; of these, 368 had acknowledged sales or savings, but 109 cases could not be estimated as to extent.

Technology for Disabled Students in Higher Education

Riqua Russell Serebreni
University of Arkansas at Fayetteville

Introduction

Serving approximately 300 students with disabilities each semester, the University of Arkansas in Fayetteville (UAF), is making every effort to develop students with disabilities into active users of computers and other types of technology. In a project grant awarded to the University by the Department of Human Services, Division of Rehabilitation Services, UAF has taken important steps to assist disabled students in moving from the position of on-lookers in a technological world to that of participants. The purpose of the project is two-fold: (a) to increase awareness of technology in students with disabilities as an enhancement to their performance, and (b) to develop the skills they need to enter the mainstream as technology dependent maximally independent performers.

The project, entitled *Campus Access and Technology* (CAT), is based on the idea that the unique needs of students with disabilities must be carefully assessed and that training in techology must be modified and often individualized if these students are to become active users. Neither assessment nor training is viewed as meaningful unless developed around an understanding of the system in which the student plans to function.

This focus on assessment and training has given the project staff an opportunity to work closely with a number of students with different types of disabilities, and thus to learn more about the impact of disabilities on technology and how the role of the user feels to the student with a disability. Additionally, the project staff has gained expertise in dealing with the large technological systems that are currently developing on many college and university campuses.

Background

Approximately 40 students are participating in the project. All are enrolled in university courses and are receiving services due to a documented disability. Of those who are participating, 4 have orthopedic impairments, 1 is deaf, 1 has a hearing impairment, 2 have visual impairments, 27 have learning disablilities, and 7 have other health impairments. All participants agreed to have their needs assessed, to participate in training sessions, and to share their experiences by completing evaluation forms at the end of the project. Students with disabilities who are also clients of the Arkansas Department of Human Services, Division of Rehabilitation Services were encouraged to participate.

The project is staffed with a project director, a licensed examiner and counselor, an accommodation/service specialist and a number of accommodators (individuals who assist students and faculty in their efforts to create an accessible environment, *e.g.* readers, interpreters, notetakers, etc. The equipment that has been purchased under the grant consists of over 30 lap-top computers, a Dec-Talk, video equipment, recorders, various materials needed to modify existing equipment, and software.

Assessment. The quality and thoroughness of each individual assessment greatly determines whether access will be limited or maximal for a student with disabilities. The complex nature of existing systems, regardless of the size, makes it impossible to decide upon the technology that will benefit an individual without first considering the structure of the system that the student wants to enter. Many questions must be answered before planning a merger between student and system. Can the student use a regular keyboard or does it need to be modified? If the student is using a lap-top in the classroom or in a particular department, is his/her software compatible with the printers in the departments where s/he will have classes or does the student need to have access to a portable printer? Will the student's instructors have the tests on disk, and if so, will the disk be the correct size for the student's computer or will it need to be down loaded onto the student's disk? Does the student enrolled in classes where computers are used by all students need to be introduced to the computer and/or software prior to the regular class session?

The informal instrument used in the project to assess need for technology was developed to define the students' current skill levels and their needs for specific accommodations when using technology. The assessment begins with a structured interview during which the examiner has an opportunity to assess the students' past experiences and levels of concern or anxiety as related to technology. Many of the students with learning disabilities who are participating in the project expressed an initial concern about using computer technology. These same students frequently reported never having taken typing or computer classes in high school or having enrolled in such classes but instead reported having dropped out or failed. Students with physical disabilities were found to be generally enthusiastic about the possibility of becoming users and appeared to have a more positive attitude toward technology than did the students with learning disabilities.

Following the interview and skills assessment, the students are asked to demonstrate their skills in using specific equipment, including their personal portable equipment. For example, the student who claims proficiency in working with taped texts or a lap-top computer such as the Versa Braille will be asked to accomplish specific tasks, *e.g.*, find a certain page or chapter on a tape. An important task for the examiner is to develop a clear picture of the accommodations the student is accustomed to, those which s/he may need to develop and how

these could be enhanced through the use of technology within a particular system.

The student with learning disabilities presents a unique challenge in both assessment and training. The complex nature of diagnosing learning disabilities and determining the manner in which they affect performance calls for expertise on the part of those assessing the needs of these students. While diagnostic testing describes a students' strengths and weaknesses, it is frequently difficult to know how these will impact on performance. For instance, students who are dyslexic or dysgraphic do not necessarily function in similar ways.

When complete, the assessment yields information on students' skills in key-boarding, typing, basic hardware and software operations, experience with specialized equipment, past training, and an estimated level of anxiety when using technology.

Training. Each assessment results in a plan which is used to structure training sessions. Once a plan has been developed, training begins. Individualized training sessions are arranged for any student whose needs are so unique that he or she cannot benefit from group instruction. Small group sessions are also available. Keeping groups small has been important since students' skill levels and needs for information varies greatly. Training consists of fairly brief periods of instruction and an expanded time for practice. While practice does not seem to increase the students' speed or accuracy when using a computer to any great extent, they appear to become more comfortable in working with computers.

Software used in training is simplified for the students in that it does not require that they work through laborious reading tasks in order to boot-up or to use specific features. The computer software used for participants with learning disabilities, as well as many others, is *PFS:First Choice* (3.00). The format for this software is easy to read and easy to follow. Other programs are currently being evaluated for their usefulness, but none have been designated as being optimal for students with disabilities.

Each training plan consist of five areas: (a) skill development, *e.g.*, the student may need to be tutored in typing or to become more literate about technology, to learn some basics about operating certain equipment, or ways to care for or transport the equipment; (b) personal adjustment, *e.g.*, the student may need to deal with anxiety or other concerns regarding technology; (c) modifications needed for hardware and/or software, *e.g.*, Does a keyboard on a computer need to be modified? Does the student with deafness need to have software modifications since some class assignments may require response to auditory cues? Do some students need the manual on tape while others need to have it re-written or read to them? (d) assistance or accommodations needed for using technology, *e.g.*, Will the student need help with setting up or operating equipment? Will environmental adjustments need to be made, such as table height, etc. ? (e) personal equipment needed within the computer system students will be entering.

Individualized training sessions are provided by both a technician who is a part of the campus department of computer services and by grant staff members. Small group sessions were conducted in a College Prep summer school program for incoming freshmen with learning disabilities and are currently offered through a class designed to help students develop academic strategies. Each training session, whether individual or group, is tailored to meet the student's individual needs. For example, a student who has use of only one finger may only need to learn about software which requires a minimal number of strokes to produce text. Additionally, this type of student may also need assistance when setting up or operating equipment. Therefore, training for this student would include opportunities to practice directing others to accomplish tasks s/he has never done him/herself. While some trainers might assume that the student would know how to tell others how to operate equipment, the staff at UAF makes no assumptions but does encourage the student to let them know when /she no longer needs all or part of the support offered.

An important last step in training is made by the student when he or she moves into the mainstream. The project staff works closely with both student and instructor at this point to the degree that both believe assistance is necessary in the transition phase.

Of the physically disabled students who are in the project., some are using technology in the mainstream while others are still preparing for the transition. Training is taking longer for the learning disabled student, which may be due to the staff-student ratio rather than the need for additional practice time.

Low Technology Devices

While training in computer technology is the central focus of this project, other technologies are also important for many students. Old guard technology, such as the fourtrack variable speed tape recorder, is as vital to the college student with a reading disability as a computer with a spell check is to the student with problems in written expression. Even the poor reader with auditory problems sometimes finds listening to as well as reading the text helpful. Skills in listening will gain in importance as computer peripherals such as voice components improve in quality. Many low technology devices are in the process of being modified to be used in conjunction with computer technology or may be replaced by computer functions. Blind and visually impaired students who enter college with poor listening skills are at a great disadvantage. Taped texts offer the student easy access to information. The recorder can be carried about easily and tapes are quite accessible from Recordings for the Blind. Articles and handouts given out by professors at the last minute can be quickly converted to tape.

Computer screen enlargements, variable character size and image enhancements are quickly replacing the need for other enlarging devices. Reading machines such as Kurtzweil are

used to transfer written material to computer disks which then can be converted to voice on a computer. Interpreters are in many cases less useful to the deaf or hearing-impaired student in the classroom than is a captioned screen that tells the student what is being said and produces an immediate transcription for the student.

New Technology

A problem area for most students with learning disabilities is that of focusing attention and taking notes during lectures. In an effort to help students focus and take the notes which they need, new technology has been developed by the project director and will be tested in the 1990 spring semester at UAF.

A prototype of this technology, called the *Notetaker*, has been built by the Arkansas Center for Technology Transfer Development at UAF and will be produced in small numbers.

Conclusion

The program has only begun at UAF. While only a few professors have actual experience in working with student with disabilities using technology, the number is growing and the reports are positive. The professor who once helped arrange for a reader or read the test to the student with visual impairments is now able to hand that student a disk to a lap-top computer with a voice component, thus allowing the student to listen to and answer each test question as independently as his or her classmates. The professor who has a student with deafness in his/her class for the first time can hear what the student thinks about the questions being asked thanks to a lap-top computer which is used to make the questions visible to the student. The student with learning disabilities, particularly in the area of written expression, can now better express his/her thoughts and ideas by using a laptop computer when completing English assignments and other written work. The student with mobility problems can now work independently in the classroom and at other locations on campus.

Students with disabilities can now equalize their opportunities through the use of technology, preparing themselves for success in both education and employment. Any knowledge the student learns and can apply in the classroom or at any other location on campus should be just as useful in future employment. The combination of higher education and technology offers the perfect training ground for the student with disabilities who aspires to meet the world as a professional and to be on equal footing with his or her peers.

The Arkansas Technology Program

Alan VanBiervliet, Ph.D.
Howard P. Parette, Jr., Ed.D.
University of Arkansas at Little Rock

Sue Gaskin
Division of Rehabilitation Services

Introduction

In an attempt to meet the technology-related needs of Arkansans with disabilities, the Technology Access for Arkansans *(TAARK)* Project was planned by six public and private agencies. Funded through a 1-year grant from the Arkansas Governor's Developmental Disabilities Planning Council and the University of Arkansas-University Affiliated Programs in Developmental Disabilities,*TAARK* was designed to: (a) identify the need and quality of technology provisions in Arkansas, (b) disseminate information about appropriate technology

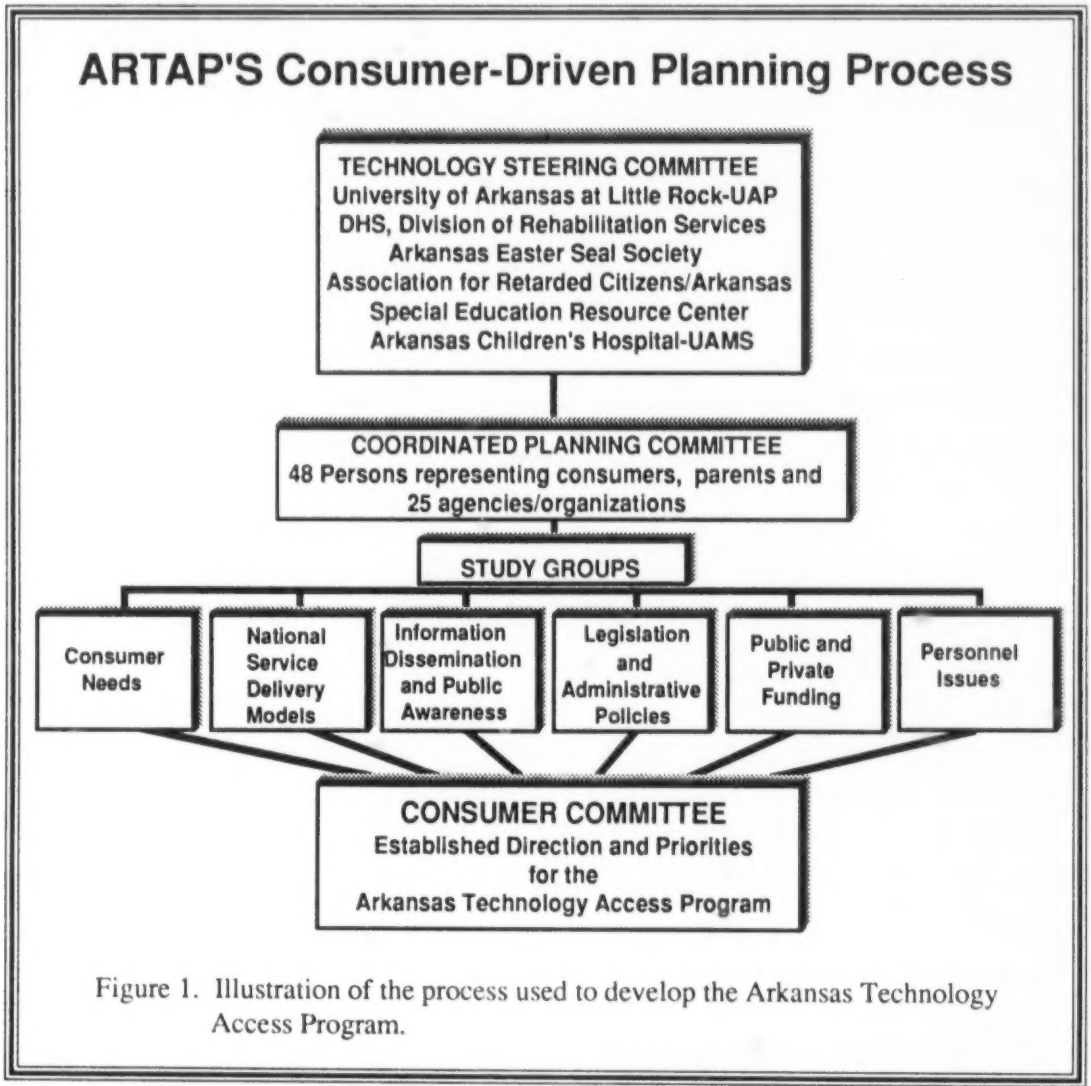

Figure 1. Illustration of the process used to develop the Arkansas Technology Access Program.

and funding, (c) educate Arkansans about technology and advocacy, (d) develop a coordinated state plan for technology , and (e) provide technical assistance to the Developmental Disabilities Planning Council.

In early November 1989, a Technology Steering Committee representing the six organizations was created. The committee's first action was to convene a larger planning group that would consist of individuals with disabilities, their families, representatives of state and private agencies, vendors, and other individuals as deemed appropriate.

Coordinated Planning Committee

A Coordinated Planning Committee was established on January 4, 1989, at a meeting which was jointly convened by *TAARK* and the Arkansas Division of Rehabilitation Services. The purpose of the Coordinated Planning Committee was to develop a state plan for a consumer-responsive statewide system of technology-related assistance, and to develop an application for P.L. 100-407. An illustration of the process used to develop Arkansas' plan for technology access is presented in Figure 1.

Since only 3 of the 15 participants in the first meeting were individuals with disabilities, parents of children with disabilities or their representatives, the participants were requested to nominate at least two individuals with disabilities or parents to serve on the committee. At the next meeting, 6 study groups were organized (see Figure 1) to facilitate the acquisition of information relevant to *TAARK* project goals. Chaired by the 6 *TAARK* Steering Committee members, each of these groups met independently from January until March to collect information relevant to the issue area targeted by the study group, identify barriers to technology access in Arkansas, and develop solutions to the barriers. The Coordinated Planning Committee met 7 times between January and July 1989, with an average of 24 persons participating in each meeting. Forty-eight persons, who represented 25 public and private agencies, participated in the meetings. Nineteen (40%) of the participants were persons with disabilities, parents of children with disabilities, or their representatives. Twelve (25%) of the participants were representatives of private non-profit organizations. Three (6%) individuals represented private businesses, such as assistive device vendors. Fourteen (29%) of the participants were employees of 12 state agencies. A few of the participants are counted twice in these figures, e.g., 4 state agency employees were also persons with disabilities or parents of children with disabilities.

A large part of the early meetings of the Coordinated Planning Committee was devoted to technology awareness and information sharing activities. National experts were hired to provide information on alternative approaches towards developing a statewide system of technology access, and to facilitate the planning process. On March 22-23, a 2-day retreat was held at to begin development of the grant application for P.L. 100-407. At this conference, verbal reports were given by each study group regarding their findings in their designated issue areas.

Written reports were submitted and compiled as a document, *Proceedings from the DeGray Lodge Retreat*, that was made available to all Coordinated Planning Committee members as well as the public on request.

Throughout the *TAARK* planning activities, the involvement of individuals with disabilities, their families or representatives, and persons from the private sector has been actively encouraged and facilitated. Inherent in the initial *TAARK* grant award was a budgetary allotment for stipends to support involvement of individuals with disabilities and their families at all planning meetings. Stipend assistance in the form of reimbursements for babysitting and/or attendants, meals, lodging, and transportation was made available to consumers and parents who participated in the retreat.

Consumer committee. At the May 10 meeting of the Coordinated Planning Committee, a decision was made to establish a group of individuals with disabilities and parents of children with disabilities selected from the Coordinated Planning Committee to identify priorities for the Arkansas grant application for P.L. 100-407. The resulting Consumer Committee reflected a constituency of persons representing a variety of interest groups. The Consumer Committee met on numerous occasions in an effort to both prioritize technology goals for the proposed grant application, as well as to offer recommendations pertaining to methodologies for attaining those goals. A representative of the Consumer Committee was present at subsequent meetings of the Technology Steering Committee to ensure that the integrity of their priorities and recommendations was maintained in the development of state plan methodologies.

Consumer input in the planning processes was encouraged from across the state via a Consumer Survey mailed to over 50,000 persons. The survey was designed to assess needs of users, or potential users of technology. The format for the survey instrument included multiple choice questions on specific technology-relevant issues, and open-ended items allowing consumers to express their unique needs and to offer suggestions for those involved in the state planning processes. These suggestions were systematically recorded and compiled for the review of those establishing priorities for the state plan as well as those designing methodologies for the implementation of those priorities. In addition to the Consumer Survey, efforts were made during the information gathering phase of Project *TAARK* to secure the input of professionals via a survey from across the state regarding their views of technology-related needs.

Additional Interagency Links

Several unique approaches have been undertaken in attempting to involve a cadre of individuals in *TAARK* activities during the state planning phase of the project. It was discovered in February 1989 that the Arkansas State Highway and Transportation Department was preparing to undertake an extensive survey to determine the transportation needs of citizens with special needs across the state as a component of its 5-year planning activities. *TAARK* personnel cultivated a collaborative working relationship with the Planning Division of this state agency.

This relationship enabled information of value to both *TAARK* and the Highway Department to be obtained and shared. Due to this cooperative working relationship, the Highway Department subsidized a significant portion of the costs for a statewide survey of persons with disabilities which was conducted prior to this grant submission.

Goals

TAARK, and the resulting Arkansas Technology Access Program *(ARTAP)* proposal, reflects the efforts of persons representing persons having disabilities as well as a cadre of organizations serving persons who have disabilities. Their shared vision has been crystallized into the following goals, objectives, activities, and anticipated outcomes. In a most basic sense, the goals do not diverge significantly from those identified in the regulations governing applications for assistance under P.L. 100-407. However, these goals are clearly linked to the unique needs of Arkansans with disabilities as identified during the *ARTAP* planning phases. They represent a systems approach towards providing appropriate assistive technology and technology-related assistance for all persons having disabilities in the state. Similarly, the objectives, activities, and outcomes are indicative of an attempt to implement a comprehensive systems change across the state with regard to the provision of assistive technology and technology-related assistance.

Following is list of the *ARTAP* goals and objectives.

Goal 1. In order to develop an on-going consumer-driven technology planning and evaluation system, an Advisory Council having a majority of consumer representation appointed by the Deputy Director of DRS will be designated. The ongoing identification of barriers and solutions to such barriers as they pertain to technology utilization in the state will be a central function of this group during *ARTAP* implementation.

Goal 2. A Technology Information System (TIS) will be created using a computer-based system that incorporates state-of-the-art concepts and technologies. The TIS will be staffed by 6 individuals consisting of a Program Director, three Information Specialists, an Administrative Assistant, and a Marketing Specialist. Information will flow outward from the TIS to the various Technology Access Centers (see Goal 3), regional technology specialists (see Goal 8), and to others accessing the system. In addition, information concerning technology that is gathered by these and other sources will be added to the system as it becomes available.

Goal 3. Five Technology Access Centers (TACs) will be developed and expanded in the state, each specializing in one of the following areas: (1) communication, (2) blind and visually impaired, (3) cognitive and language habilitation,(4) deaf and hard of hearing, and (5) independent living. Two TACs will specialize in independent living as it was determined that there was a great need throughout Arkansas for these services. Except for the Independent Living TACs, each of which will serve only half of the state, all other TACs will be responsible for providing services to the entire state. The general responsibilities of each TAC will be to freely provide

information and hands-on demonstration concerning targeted technology devices and approaches to consumers, parents, professionals, employers, business, and the general public. The TACs will also provide and participate in training activities concerning technology and awareness; provide technical assistance to consumers, professionals, policy makers and the TIS; and generate information concerning technology and services. In addition, TACs will provide formal evaluations and other services, such as therapy and device construction, for a fee. Finally, each TAC will be required to participate fully in the evaluation of its own activities and those of the statewide technology system. The TACs will maintain a computerized record of the technology and information resources that it possesses, and this database will be shared with the TIS, other TACs, Technology Specialists, and others across the state concerned with technology access.

Goal 4. The establishment of a marketing and public awareness campaign to promote the benefits and use of technology for persons with disabilities will be developed and implemented by the Marketing Specialist and a marketing firm.

Goal 5. Coordinated training activities for consumers, their families, professionals, employers and the general public concerning technology-related services will be developed and implemented. Based on a variety of assessment data regarding training needs, TIS staff, TAC personnel , and consultants will conduct training activities in the area of assistive technology at a variety of state meetings, university-based settings, and in public and private agency settings. *ARTAP* will investigate and use distance teaching approaches (e.g., conference calls, teleconferences, and instructional video tapes) in order to efficiently reach statewide audiences.

Goal 6. A statewide system for equipment exchange of used assistive devices will be developed, utilizing a registry of such devices that is stored in the TIS database that is accessible to all persons in the state. Efforts will be made to publish print and audio materials relating to the availability of used assistive devices around the state and to disseminate these materials on a regional and state level to potential consumers of such used devices. The TACs, once developed, will assume joint responsibility with the TIS for the acquisition of this type of information as well as for dissemination and marketing of the program. The regional technology specialists will be given information regarding used assistive technology in their regions, and be trained to secure this information on a regional basis and to share the information with the TIS.

Goal 7. The improvement of interagency cooperation to develop consumer- responsive policies and procedures regarding technology services will be facilitated through the establishment of an Interagency Council. Consisting of policy-making staff from numerous agencies, the Interagency Council will have direct communication links with the *ARTAP* Technology Advisory Council by having some members in common and by the appointment of a liaison between committees.

Goal 8. A network of community-based technology specialists responsive to consumers and their families will be established in each of the 8 regions of the state. The regional technology specialists will: assist in identifying local barriers and solutions; implement those solutions; identify local training needs; conduct and sponsor training on a local level; provide technology-related assistance and support to persons with disabilities, their families and professionals; and provide information to the TIS concerning local resources. In addition, the Regional Technology Specialists will assist in organizing local resources, such as the Pioneers of America and technical college students, as support for ongoing assistive device services and projects.

Goal 9. A User-to-User network will be developed, implemented, and evaluated. It will place consumers and their families in touch with other individuals who have used specific assistive devices and technology services. Participants will be identified and entered into a registry employing a computer database housed at the TIS. All TACs will be contacted by *ARTAP* personnel and given a listing of the names, addresses, and telephone numbers of those involved in the network.

Issues in Amplification and Listening Devices

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Hearing aids and other assistive listening devices have been available for many years. Changes that have occurred throughout the years include miniaturization, smaller, rechargeable power systems, and to some extent, improved sound quality. Of course, with the recent advent of legislation on accessibility and the technology explosion, still other changes are occurring.

New devices must allow the person free mobility, and access to the media and the telephone. Hundreds of amplification devices are now on the market, but many serious issues are still unresolved. Technology relates directly to some of the issues, while for other problems it is not a primary factor.

A major technology area is the application of digital signal processing in cochlear implants and hearing aids. Standard hearing aids and assistive listening devices are analog systems where the output from the signal is just an amplified version of the input. The stimulus is shaped some by the electronic characteristics of the devices such as distortion, frequency response, and limiter type. These effects generally result in the individual receiving a low fidelity signal which may or may not improve communication.

The present preferred cochlear implant device is a 22-channel digital processor which selectively determines what acoustic information will be processed and provided to the user. This allows for a better signal-to-noise ratio than analog systems, and all but eliminates distortion. However, the problem is in determining the best decisions for the device regarding what information to digitize. Basically, the goal is to maximize speech perception while reducing background noise. Thus far, best performance has been achieved when the person is provided with fundamental frequency and formants 1, 2, and 3. This information allows some individuals to perform closed and some open set word discrimination. Other extraction models are still under investigation.

The digital concepts used with the cochlear implant devices are beginning to be transferred to hearing aid design. A number of digital and analog/digital (hybrid~ prototype instruments are available. In the hybrid instruments, digital components are used to control analog circuitry. Basically, they allow more control and more options than traditional hearing aids. Since the basic issue of hearing aids is how to maximize speech perception in noise, most of the newer designs have been developed to improve speech-in-noise listening. Multiple band, full range compressional, and time domain signal processing are two such attempts.

At this time, several digital and hybrid instruments are available, with hybrid much more prevalent. They represent an entirely new fitting concept to dispensers, require the purchase of expensive programming equipment, and are expensive for the consumer. The digital systems are still large and bulky because of the increased power needs. Conceptually and clinically, digital and digital-analog systems are in an infant state. The present aids represent the wave of the future. The dilemma is determining when to recommend them for a patient since the instruments are in a developmental stage.

I would like now to discuss an issue that is less related to technology, or at least, related in a different way. Many types of amplification devices are available for general improvement of hearing or for specific listening needs. However, data show that the target population is poorly informed about the devices available, where to secure, their cost, etc. Figure 1, taken from the Alpiner and McCarthy text[3], shows how unfamiliar hearing impaired persons are with various types of devices. These data suggest that professionals in the hearing health fields are doing a poor job of informing and educating the public. Audiologists offer many reasons for this situation, including a fear that if persons learned of alternative devices to traditional hearing aids, sale of aids might decrease. They also report that persons are not interested in the devices, however, Figure 2 suggests considerable client interest. So the issue of marketing the devices, including hearing aids, remains an issue. It is estimated that only 12% of potential hearing aid users are presently wearing aids.

Another issue relates to compatibility of instruments. The ideal situation for many persons would be for selected assistive devices to be compatible with their hearing aids. However, this is not necessarily a simple task. Many hearing aids either do not have a magnetic induction coil (telecoil) or have a very poor one. Thus, auditory trainers, magnetic loop systems, and telephone headsets are not effective. Some churches and public facilities have elected to use infrared systems, which require use of special headsets not compatible with hearing aids. There are many (perhaps 30-40) telephone amplifiers presently available, but each has it s own idiosyncracies. Some will work on most phones, some only on traditional phones, some on electronic phones, and so on. Therefore, fitting the most suitable device is no simple task.

Selecting amplification devices remains a mixture of science and art. Hearing aid selection procedures have evolved along with technological advances from comparative procedures using primarily speech discrimination scores in quiet, to computer-selected hearing aid characteristics, based on audiometric data.

Probe tube microphone measures are also being used widely. This technique shows the sound pressure level across frequency that is actually reaching the clients tympanic membrane. When this reading closely matches an expected curve derived from a computer program or

formula, then the fitter assumes the client is receiving maximum beneficial amplification. Refinement of the formulas for calculating appropriate gain, frequency response, and saturation sound pressure level continues.

Selection of devices other than hearing aids is even less scientific and rarely dependent upon technology. Figure 34, is an example of a questionnaire that has been used to determine the need for a special device. However, it can be readily seen that this 'evaluation tool simply identifies problem listening situations; it does not provide any information about the client s hearing. To-date, no formal, consistent techniques have been developed for fitting of assistive listening devices.

A final issue relates to standards and specifications for devices, particularly non-hearing aid devices. Presently, there are no standards, therefore, professionals trying to provide devices have little or no information regarding acoustics, power, or electronic characteristics. Most devices carry short, limited warranties, and few have been on the market sufficiently long to determine quality, durability, or stability. These issues tend to make professionals wary and hesitant to market the devices.

In summary, a number of issues need to be addressed, some directly related to the application of technology to amplification devices for those with impaired hearing. Much research is currently in progress applying digital audio processing techniques for special purposes of speech perception. Other issues of marketing, evaluating, and quality control are currently receiving less attention. These tasks may be the responsibility, primarily, of the clinician rather than the laboratory scientist. So, a coordinated effort between the lab and the clinic needs to be organized in order to maximize the technological advantages to the person with a hearing loss.

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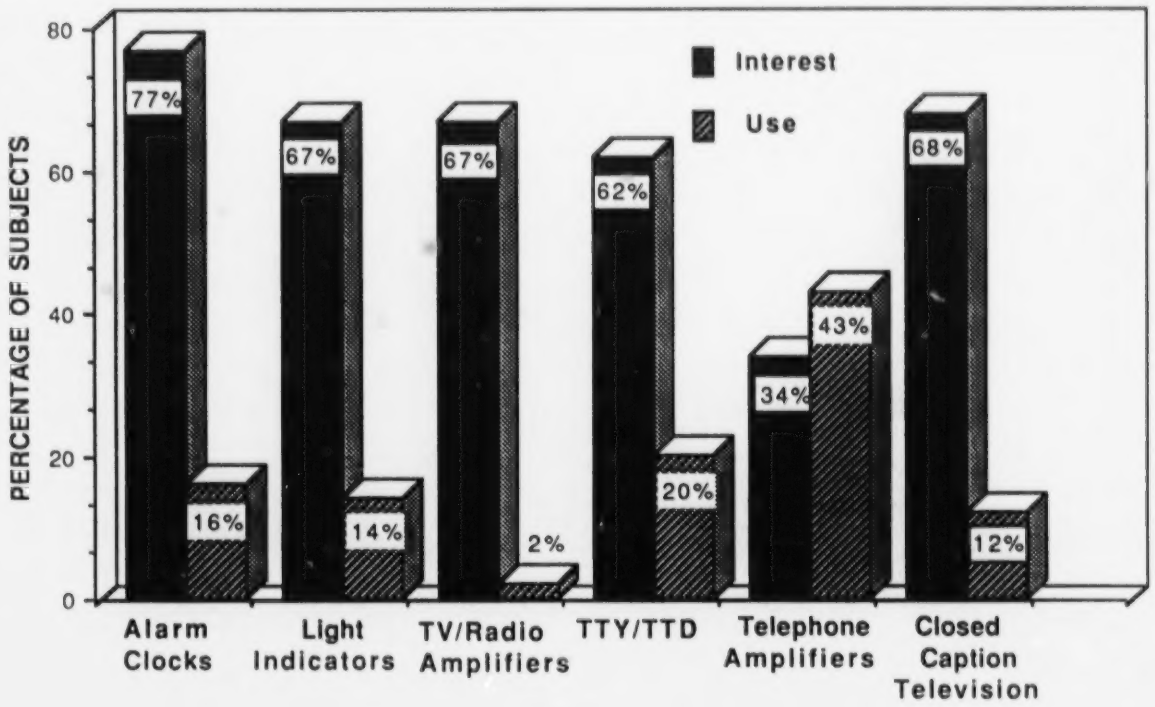

Figure 1. Familiarity of hearing impaired consumers with assistive devices. Reprinted with permission from McCarthy, P. Culpepper, N.B., & Winstead, T.G. (1983). Hearing impaired consumers' awareness and attitides regarding auditory assistive devices. Paper presented at the Annual Convention of the American Speech-Language-Hearing Association, Cincinnati, Ohio.

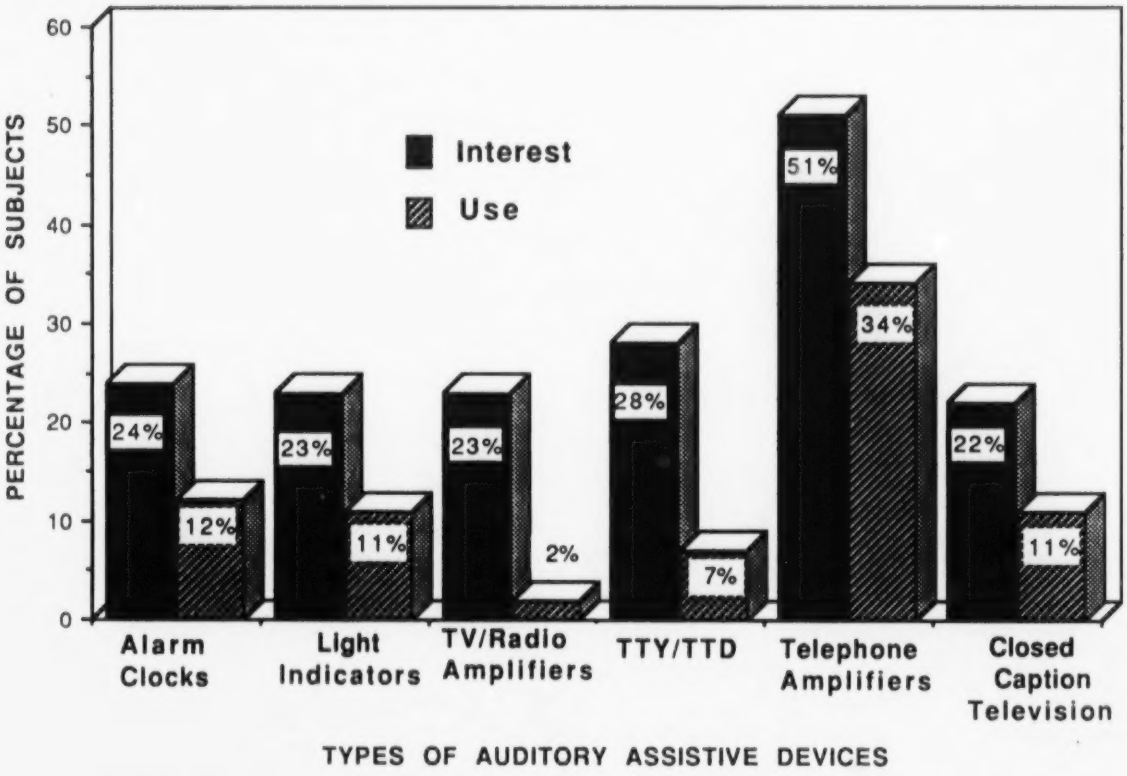

Figure 2. Hearing impaired consumers' interest in purchasing assistive devices. Reprinted with permission from McCarthy,P., Culpepper, N.B., & Winstead, T.G. (1983). Hearing impaired consumers' awareness and attitudes regarding auditory assistive devices. Paper presented at the Annual Convention of the American Speech-Language-Hearing Association, Cincinnati, Ohio.

listening and talking selection checklist

Some of the information that would help us make suggestions concerning assistive listening devices and large area sound systems is listed below. If you want us to assist you further, please check the appropriate items and return this form to us.

---

listening and talking situations

I have difficulty understanding:

_____television or radio
_____one person at mealtime or around home
_____around a conference table
_____a small family group
_____in the theater (play)
_____at church
_____in a conference or lecture hall
_____other (please list)

___in an automobile
___in a restaurant or dining room
___at a party
___walking down the street
___in the movies
___in a classroom

_____
_____
_____

---

amplification devices

_____I do not have a hearing aid.
_____I am pleased with my hearing aid.
_____I do not wish to use a regular hearing aid.
_____My hearing aid has a telephone switch.
_____I can afford an alternative system that costs:

_____$100.00 _____$300.00 _____$600.00

---

large area sound systems

My community has the following systems:

_____Hardware (_____church, ____theater, _____movies, _____other)
_____Infrared (_____church, _____theater, _____movies, _____other)
_____FM (_____church, ___theater, _____movies, _____other)
_____Loop (_____church, _____theater, _____movies, _____other)

The Role of RESNA in the Provision of Technical Assistance and Information in Response to P.L. 100-407

Patricia Beattie

RESNA Technical Assistance Project

Introduction

RESNA, an interdisciplinary association for the advancement of rehabilitation and assistive technologies, has been awarded a contract by the National Institute on Disability and Rehabilitation Research (NIDRR). The purpose of this contract is to provide technical assistance and information to States on the development and implementation of a consumer-responsive statewide program of technology-related assistance under P.L. 100-407, *the Technology-Related Assistance for Persons with Disabilities Act of 1989*. The purpose of this act is to provide discretionary funds to States on a competitive basis to develop such a system.

The first nine states to receive funding under P.L. 100-407 are Arkansas, Colorado, Illinois, Kentucky, Maine, Maryland, Minnesota, Nebraska, and Utah.

NIDRR will be funding additional states each year. It is hoped that all 50 states and territories will be funded by 1995.

Services

This contract provides RESNA the resources to:

- develop technical assistance plans for the States receiving funding under P.L. 100-407;
- produce a directory of expert consultants in assistive technology services;
- publish a newsletter *Technology Assistance Quarterly* , and other written materials on the delivery of assistive technology services;
- provide States access to an electronic bulletin board designed to share information among states and interested parties;
- design and evaluation package to analyze States' progress towards the development of a consumer-responsive assistive technology delivery system;
- host three meetings especially designed to meet the needs of States as they develop their state systems;
- bring together an office of professionals in the area of assistive technology who can provide on-going support to States and individuals;
- organize a library of information which will foster the development of assistive technology services; and

- provide technical assistance to states and other interested parties through visits, telephone, or by mail on developing consumer-responsive systems of assistive technology.

Please feel free to contact our office (202/857-1199; FAX: 202/775-2625) if we can be of assistance to you.

User Friendly Homes for Today and Tomorrow

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Introduction

The focus of this paper is on the development and current status of a Quality of Life for Persons with Disabilities program in the College of Home Economics at Oklahoma State University. Utilizing a state-of-the-art accessible/adaptable home as its laboratory, the program includes, in addition to research and instruction, a broad public service dimension. Components of the public service program are information and referral, direct service to clients, tours, presentations for various groups, advocacy for the disabled and technical assistance to industry. Based in an empowerment model, the primary goal of the program is to help persons with disabilities live independently in the environments of their choice. The program is an example of how the private sector has become a partner in Oklahoma State University's goal to use its resources in improving the quality of life of persons with disabilities.

The Need for Independent Living Resources

Today, millions of families in this country and abroad are considering the age-old problem of how to make life more livable for a disabled loved one. According to Carling (1989), thirty-seven million Americans, those with physical or mental disabilities are at risk of being excluded from the American dream. At the center of the American dream is the ability to live independently in a hone of one's choice and to work in a comfortable, accessible environment. In despair, many families of persons with disabilities have given up the "dream" for a real world of inconvenience, discomfort, frustration and erosion of self esteem. Lacking information and other resources, they are unable to obtain living environments that facilitate independence and self confidence; environments that offer comfort, safety, and convenience for family members who range from minimally to severely disabled. When these families live in rural areas, isolated from the resources of urban communities, the problems are compounded.

The Development of the Bartlett Independent Living Laboratory

In the early 80's, the College of Home Economics at Oklahoma State University made the decision to increase its instruction, research and public service emphases on the Quality of Life for Persons with Disabilities. Faculty and administrators in the College saw the need and

the possibility of focusing academic resources within the five departments (Home Economics Education and Community Services; Family Relations and Child Development: Food, Nutrition and Institution Administration; Clothing, Textiles and Merchandising; and Housing, Interior Design and Consumer Studies).and the School of Hotel and Restaurant Administration on helping people with disabilities live independently, comfortably, conveniently and safely.

The College's Dream

In 1980, Oklahoma State University launched its Centennial Decade. As a part of Centennial Decade activities, academic units within the University initiated planning programs which included reflecting on the past and developing priorities for the future. As a result of the planning process, the College of Home Economics decided to renew its emphasis on the needs of persons with disabilities. One of the College's goals for the Centennial Decade was to renovate an existing home to make it a state-of-the-art laboratory featuring barrier free design. The laboratory, when completed would serve as a focal point for research, instruction and public service focusing on the theme: *Quality of Life for Persons with Disabilities.*

Unfortunately, plans for capital improvements did not fare well in a state with a declining economy. Oklahoma was suffering from the blows of the "oil bust." If a new laboratory was to be realized, the funds would have to come from the private sector.

The Major Donor

F. M. "Petel' Bartlett, a graduate of Oklahoma State University and a successful business man/entrepreneur in Tulsa, was interested in the College of Home Economics' plans to build a program focused on improving the quality of life for persons with disabilities. In 1985, he contributed $100,000 toward the renovation of a three bedroom home once used by the College as a home management laboratory. Mr. Bartlett had served for several years as a board member and contributor to the Tulsa Center for the Physically Limited. His commitment to the quality of life for persons with disabilities was an inspiration to the faculty; his gift a financial resource which put brick and mortar around the "dream." Before the Laboratory was completed, Mr. Bartlett, the major donor, passed away. Three years later members of his family maintain a continuing interest in the program and are vital links to resources in the state.

In April, 1988, a symbolic ground breaking ceremony marked the beginning of the construction phase of the Laboratory. The budget for the construction project exceeded the dollars on hand creating the need to raise money for landscaping, furnishings and equipment. With the help of the Oklahoma State University Foundation, aggressive efforts to obtain the support of the private sector were initiated. By October 1, 1988, funds for some of the furnishings had been obtained. By October 1, 1989, one year after opening day approximately S70, 000 had been contributed by about 60 donors including individuals, associations, civic organizations, student clubs, businesses and foundations. In December, 1989, new plans for

continued fund raising are being developed. faculty have taken the position that "the Laboratory will never be finished." As technology improves, the Laboratory must change. Funds will always be needed to support the innovative research, instruction and service programs focused on Quality of Life for Persons with Disabilities.

The Bartlett Independent Living Laboratory Today

The Bartlett Independent Living Laboratory opened October 1, 1988. The Lab is the focus of an interdisciplinary emphasis on the quality of life for persons with disabilities administered through the College of Home Economics. A discussion of the mission of the College and the philosophical and theoretical bases for the program will be helpful in understanding the orientation of the program.

The Philosophical Base

The philosophical base for the Quality of Life for Persons with Disabilities program resides in the mission of the College and the opportunities inherent in the empowerment process.

The mission of the college. The College of Home Economics at Oklahoma State University prepares and supports professionals who assist individuals and families in attaining personal and social well-being in the context of the physical, aesthetic, economic and community environments. Baccalaureate, master's and doctoral programs provide an integrative perspective regarding human interfaces with diverse systems. Basic and applied research expand knowledge and technology for the enhancement of life. Outreach services are provided through Cooperative and University Extension.

A concern for the enhancement of the quality of life for individuals and families is ~ theme that permeates the curricula of each of the professional majors within the College. Consistent with this theme, an emphasis on improving the quality of life of persons with disabilities is relevant to each of the College's academic programs which include the following areas of study: community-services, family services, family relations, early childhood development, youth development, adult development and gerontology, clothing and textiles, apparel design, apparel marketing, food and nutrition, consumer studies, housing, interior design, management of volunteer programs, home economics education, and hotel and restaurant administration.

The empowerment process. Throughout the various academic programs within the college is a commitment to the process of *empowerment*, i.e, .enabling individuals to have control over their own lives by maximally utilizing resources in the achievement of a satisfying lifestyle. According to Barr (Human Service Workers, 1989), empowerment is a process that involves both personal and institutional change culminating in increased access to information

and other resources among individuals. The Cornell Empowerment Group of which Barr is a member (Ford Funds Cornell, 1989) further defines empowerment as follows:

> Empowerment is an intentional, ongoing process centered in the local community, involving mutual respect, critical reflection, caring, and group participation, through which people lacking an equal share of valued resources gain greater access to and control over those resources. (p. 1)

The program in Quality of Life for Persons with Disabilities in the OSU College of Home Economics is based upon assumptions very similar to those articulated by the Cornell Empowerment Group and the family support services movement (Kagan, Powell, Weissbourd, & Zigler, 1987). The assumptions that undergird the program are as follows:

- All individuals have worth, dignity, and abilities; all families have strength~. Human services based on a strengths model rather than a deficit model contribute best to empowerment
- Individual human uniqueness is positively valued.
- All individuals and families at some time need help.
- Individuals and families grow and develop through interaction and interface with a variety of environmental systems, from local to global.
- Issues of power and issues of resource distribution are inextricably interwoven.
- The valued resources of a free society should be accessible to all.
- Each individual in a free society has responsibilities to self, to family and to the community.
- All persons should be able to live independently in the environments of their choice and work in settings appropriate to their preferences and abilities.
- All individuals and families deserve the right to live in a caring, supportive community. The strength of the family and the strength of the community are integrally related; as a family grows stronger, so too does the community.
- The chief role of professionals who work with families is to empower.

The Bartlett Independent Living Laboratory: A Demonstration of A User Friendly Environment

A 1940's home that once stood as a lonely reminder of a curriculum emphasis no longer viable was renovated in 1988 to become an example of how existing and/or new housing can be made "user friendly" for people with disabilities. The renovation of the three bedroom, two bath, one carport modified contemporary home included the addition of gently sloping ramps, new entries, widened doorways, and enlarged bath, low thresholds, and other structural improvements.

Ideas for the 1,750 square feet laboratory were developed by a faculty committee with the consultation of Ronald L. Mace , AIA, of Barrier Free Environments of Raleigh, North Carolina, who developed the preliminary architectural drawings. Final drawings were developed by Nichael Skaistis, AIA, and Carol Bormann, ASID, both with Architectural Services, Oklahoma State University. The contractor for the project was Robert Johnson of Oklahoma City. Supervision of the construction project was provided by Oklahoma State University Architectural Services.

The "user friendly" features of the Laboratory will be discussed in the following order: (a) universal design, (b) adjustable-height work centers, (c) mobility features, (d) motorized features, (e) environmental control systems, (f) communications technology, (g) personal care equipment, (h) major household appliances, (i) safety devices, and (j) other furnishings.

Universal design. The concept of universal design, while in its infancy is beginning to grow in our consciousness and will surely be applied more completely in the homes of the future. Universal design simply means barrier free for everyone (*e.g*, for information about barrier free designs, see Bostrum, Mace, and Long , 1987).. In a special report on universal design in its October, 1988 issue, Home (On the eve, 1988) stated that "universal design doesn't impose solutions for only the fittest over the needs of the less able. It transcends ability with innovation. It's design that works for everyone" (p. 101).

As examples of universal design, the Bartlett Independent Living Laboratory features the following:

- Lever handles are used instead of round door knobs that are difficult to grip. Grasping a standard door knob is a special problem for those who suffer arthritis. One door in the laboratory demonstrates an add-on plastic lever which inexpensively converts a standard round knob into a lever handle. The round knob is also scored to show how gripping can be made easier if only a round knob must be used.
- Pull-out baskets are used in cabinet areas to improve the access to the storage areas. In corner cabinets, revolving lazy Susan type baskets pull out for quick access to stored items.
- Pull-out shelves are located in food preparation centers. A pull-out shelf under an oven or microwave provides a convenient, safe place for a wheelchair user to park a hot container of food before making the transition to the next location. When not in use the shelf may be pushed back into the cabinet.
- Auxiliary handles are placed near the hinged side of all doors to allow a wheelchair user who has just left a room a way of closing the door conveniently. Reaching back to grasp a handle on the unhinged side of the door is awkward for a chair user and slows mobility considerably. Nondisabled people are similarly assisted by the auxil~

iary handles. The auxiliary handles are a simple elongated loop type construction that responds to a pull by one finger or a prosthesis.

- A tactile thermostat marketed by Sears can be used by totally blind persons but offers a distinct, time saving advantage to sighted people as well. A permanent metal tab marks the location of 70 degrees on the temperature selector. One click up or down indicates a variance of two degrees.
- Package shelves (34" high) are located at the entrances to the Laboratory. A package shelf provides a place where someone can place books, groceries or other packages while they unlock the door to gain entry. Once the door is open, packages can be reclaimed without having to stoop or bend which would be difficult for some people.
- Push-button light switches are used in the Lab. A pushbutton switch may be activated with a very light touch, even a mouth stick, whereas a standard switch is more difficult to operate.
- The faucets in the Laboratory are a single lever handle variety which require very little pressure to operate. According to Raschko (1982), an extended lever handle provides for mechanical leverage with a vertical force, a motion considered simpler for those with disabilities. The faucets in the kitchen and in the two bathrooms are each different examples of faucets that are easy to use by anyone.

Adjustable height work centers. Adjustable height work centers are demonstrated in five areas of the home: the kitchen sink, the cooktop unit, a window area work surface near the washer and dryer and two desktop/counter units. The adjustable height work counters are mounted on heavy duty wall shelf supports. This type of installation allows a wheelchair user to pull under the counter and get close enough to work comfortably. The adjustable height kitchen sink is a quasipermanent mount which requires more labor than the other counters to remove and replace. European designs which can be raised and lowered by a simple lever are available in freestanding bathroom sinks. One example is the "Lift" from Villeroy and Boch. Other examples are LIFTSHELF and Granberg Superior cabinets.

Features to enhance mobility. Mobility in the Laboratory is enhanced by wide passageways, open spaces, low thresholds, and simplicity in furniture arrangement. Other features that are helpful to people who have mobility concerns are hand rails or grab bars, metal plates on doors, deep toe spaces under cabinets, swing clear hinges and skid resistant floor surfaces.

- Grab bars in bathrooms are helpful to many people, but especially to those who need help in maintaining balance or who need additional support for transferring to a toilet seat, tub or shower. Two types of grab bars are demonstrated in the Laboratory; one is a brushed stainless steel variety, the other is a vinyl coated bar color coordinated

with the decor of the bathroom. With greater choices in grab bar design, homes of the future are more likely to have grab bars as standard features. An important concept in adaptable housing is to be sure that walls are reinforced for grab bars in all new construction even if they are not installed immediately. Such planning prevents the added expense of tearing out walls

- Metal protectors that cover the lower portion of the doors in the Laboratory demonstrate ways that door surfaces can be protected from unavoidable scratches and smudges occasionally caused by wheelchairs. The use of some type of protective cover provides a greater sense of freedom for chair users who might be concerned about marring finishes.
- Another feature that helps a wheelchair user is the deep toe spaces provided under the wall cabinets. A deeper space makes it possible for a wheelchair user to pull up to the cabinet to remove or place items in storage. A toe space l' O" high by l' O" deep is desirable. The larger toe space also provides more space at the floor level for maneuvering a wheelchair.
- Floor surfaces in the Laboratory were particularly selected with easy mobility in mind. A low pile commercial grade carpet offers little resistance to a wheelchair and is also suitable for older persons who use walkers or other ambulatory aids. A skid resistant entryway tile helps control for falls even when the floor surface is wet. Each year, thousands of older Americans are injured in and around their homes (United States Consumer Product Safety Commission, 1986). Many of these accidents are caused by slippery or uneven floor surfaces.
- Swing-clear hinges are a simple, practical way of widening passageways without making major structural changes. When a door is standing open, the thickness of the door reduces the clearance in the doorway if standard hinges are used. The installation of off-set or swing-clear hinges widens the opening by a space equivalent to the thickness of the door. A doorway may then provide the minimum space required by ANSI A117.1 (American National Standards Institute, 1980) for a wheelchair user to pass through safely. Swing-clear hinges are available from several vendors; the product in place in the Bartlett Independent Living Laboratory is by Stanley.

Motorized features. Among the more sophisticated and expensive features in the Laboratory are the motorized door, the motorized window and the motorized blinds. Descriptions of these features are as follows:

- A door equipped with a slow moving low-force power-assist operator is installed at the side entry of the Laboratory. The door opening device is available under the brand name, Stanley Magic Door. The motor is mounted outside above the door in a

recessed entryway. The motor is easy to install. The arm does not have to be attached to the door itself. Touch control wall switches, a floor switch and remote control switches allow access. In addition, the door may be opened manually. As a security measure, the externally mounted touch control switch may be rendered inoperable by a key switch. The timing device on the motorized door opener is set for 15 seconds which seems to be ample time to allow a wheelchair user to pass through the doorway.

- An electric window opener has been installed to provide access to the upper level of an awning type window. The window opening device by Andersen opens and closes the window automatically. The electronic opener at the Laboratory makes it possible for a wheelchair user to open a hard to reach upper portion of a window installed over an adjustable height counter in the kitchen. The opener kit included the power operator, the command center, power supply, mounting bracket, rain sensor, and cords. The rain sensor has been a novelty item for most of the people who have visited the Laboratory.
- Two other locations in the Laboratory feature motorization. The vertical blinds installed in the dining room and living room may be rotated or opened and closed with a remote control or wall mounted switch. The LouverMatic II from LouverDrape offers the convenience of both power traverse and power rotation without bulky conspicuous motors and drive cords. The verticals may be adjusted for light control and privacy from a chair or other favorite location. Mini blinds in the master bedroom are also equipped with a motorized opener.
- A motorized feature not yet available for demonstration, but highly desirable for the Laboratory, is the Granberg Superior motorized height-adjustable kitchen cabinet. The Granberg motorized cabinets were designed in Sweden and have been tested in Europe for residential and commercial use. The cabinets may be easily adjusted by lower cabinets can be immediately adjusted to the desired height, thereby making the cabinet universally accessible.

Environmental control systems. As a part of the plan to make the Laboratory a demonstration of a user-friendly home, environmental control systems of various types are in place.

- Through the use of X-10 POWERHOUSE mini controllers, lamp modules, appliance modules and radio transmitters/receivers, occupants of the Laboratory may turn lamps and appliances "on" and "off" from any location in the home. Appliances and lamps may be operated individually or with one selection; everything may be turned "off"

simultaneously. The mini controllers may be plugged directly into a power source or via a Transceiver, remote control is possible. At a nominal price, environmental control modules offer may fascinating alternatives for getting a home to respond on command.

- The X-10 POWERHOUSE Home Control Interface can make a home look and sound lived in all of the time, a valued security measure. The system does this by turning lights and appliances "on" and "off" at preprogrammed times. The Home Control Interface tells the modules (described above) what to do. Via computer signals, commands are sent over existing house wiring to the modules (appliances or lamps) of choice. The Home Control system is capable of handling up to 256 appliances or switches. One may predetermine the time and intensity at which a lamp comes "on" or the time and volume for radios, stereos or TVs. A system of this type can be operated via a sip and puff, eye switch, or Voice synthesizer and can be tremendously important to the quality of life for persons with severe disabilities.
- A software system, Cintex, offers environmental control as one of its various features. Cintex, developed by NanoPac, Inc. of Tulsa, Oklahoma, enables severely disabled individuals to use a personal computer to improve independence and communications. In addition to environmental control, other features of Cintex are word processing, letter prediction, word prediction, artificial intelligence, speech synthesis, telephony, files, note pad, music composition, calculator, printing, and switch input.

Communications technology. The ability to communicate is one of life's most treasured gifts. When the communications process is limited by disability, technology must respond in ways which give back the opportunity to be "in touch" with others.

- A Freedom Phone ®, Southwestern Bell Telecom FM 3500 speakerphone makes "hands free" calling a possibility. With a mouth stick and 10 memory dialing feature, favorite numbers can be called with little effort. The Freedom Phone FM 3500 also offers automatic redial and is pulse/tone switchable. Other features include a lighted dialing pad, automatic shut off for radio, clock/timer, radio/alarm switch, snooze/timer bar, ringer switch, dimmer switch and hearing aid compatibility.
- The Bartlett Independent Living Laboratory has a customized complete home phone system. The new Plexar™ for the home offers intercom calling, call hold, call pickup, call transfer, three-way calling, call waiting, call forwarding and speed calling. Any of these technological features offer advantages for everyone but are especially helpful to persons with disabilities. As an example, the intercom capability with a speaker phone allows family members to talk from work center to work center, room to room in the

home. This feature allows one person to be working in the kitchen and stay in touch with a disabled person who might be resting in a bedroom. With the intercom system, shouting through the house or running from room to room is unnecessary. Further, the speed calling feature is very helpful to people with disabilities. Up to six frequently called numbers can be shortened to two digits making dialing easier.

- An AT&T 1310 Plus Video Communication Terminal (VCT) offers many features that would be helpful to anyone, but especially helpful to persons with hearing impairments. The VCT lets the user converse with all other terminals with 45.5 Baudot. When "talking" on the VCT, the user may see a split screen that shows the message he/she is sending as well as the message being received at the same time. When placing a call, visual messages such as "dial tone," "no dial tone," "ringing," "line busy," etc., show the progress of the call. An emergency message feature lets the user store important personal information in the terminal's memory.
- Other devices that assist with the communications process are an AT&T Signalman™ Controller that automatically flashes a lamp when the phone is ringing, a cordless phone and the telephoning components of the environmental control software programs used in the Laboratory, *e.g.* Cintex and the Sinites Scientific Personal Care System.

Personal care equipment. In the future, there is great potential for industry to develop, test and improve technology which impacts the personal care of those with disabilities. The following units are currently available in the Bartlett Independent Living Laboratory. Other systems are being monitored for future acquisitions.

- The Personal Care System developed by Sinties Scientific, Inc. of Tulsa is a state-of-the-art product designed to address the needs of the physically challenged individual. The Personal Care System, actually a robot, helps a disabled person achieve increased independence and mobility, and as a consequence, may substantially reduce attendant care costs. The Sinties robotic technology provides the user with environmental controls, self feeding and the ability to do productive work. Using the voice controlled computer to turn on lights, answer the phone, control a television, and other functions such as controlling the movements of the robotic arm, a person with disabilities exercises control over his/her own life. The selection of end-of-arm accessories allows the robot to perform a wide variety of tasks for the user, such as providing food, drink and medicines.
- A portable lift by Porto-Lift is an example of a personal care unit available in the Lab. Floor sockets have been installed in three locations, by the beds in two rooms and by the bathtub, to show how the lift may be removed from one area of use and taken to

another. This type of lift, relatively lightweight and low cost, is convenient for use in residential settings. It requires that an attendant assist the disabled person but *all* the lifting *is done mechanically*. The floor receptacle or socket provides strong support for a person seated in the lift. When the Porto-Lift is not in use, it may be removed, collapsed and stored in a small space. The ceiling of the Laboratory has been reinforced for future installation of a sophisticated electronic overhead lift. The use of lifting technologically is extremely important to the independence of persons with disabilities but is also an absolute necessity for the health of caregivers.

- Other examples of personal care technology in the Laboratory include an add-on bath and shower seat which facilitate transfer from chair to tub, a fold-down shower seat which, again, provides a safe method of transferring from chair to shower, and Alsons Personal Shower System which includes an adjustable-height and removable shower head.

There is encouragement that United States designers are courting the expanding market of older and disabled persons. Articles in trade and/or product magazines and in publications that target persons with disabilities indicate that an increasing array of choices will hit the market in the months ahead. According to Cole (1989), persons over the age of 50 are controlling roughly half of the nation's discretionary income; companies are starting to realize that designing everyday products for people who've lost some strength and dexterity is good business.

Household appliances. Taking the "drudge" out of daily living was a special consideration when selecting the major appliances for the Laboratory. The daily struggles with appliance doors that open the wrong way, controls that are difficult to reach and features that are hostile to the user, are additive. The day-by-day accumulation of frustrations and inconveniences tends to erode the feeling of being able to cope. Despair and dependency may result. The United States home appliance industry has a long way to go in achieving accessibility for all, yet, the following examples are attempts toward the reality of "user-friendly" environments.

- The side-by-side refrigerator featured in the Laboratory kitchen has front mounted digital controls. Signals indicate the temperature of food, when the door is open, when service should be called, or when the electricity has been off. Programming capability allows the user to control temperatures for time of day or week and to adjust to higher temperatures when on vacation. Easy to reach water and ice dispensers are another convenience item. The refrigerator was designed and manufactured by

Whirlpool, distributed by Sears. In the future, it is expected that there will be more third door shallow refrigerated storage options that can be reached without opening the main door of the refrigerator.

- The washing machine selected for the Laboratory is front loading, an item of importance to wheelchair users; however, a washing machine with front mounted control panels was not available for installation. Models with rear console controls are virtually impossible to operate from a seated position (Designs for Independent Living, n.d.). Designs with front loading, side opening, near consoles are a high priority for future development.
- A microwave by Whirlpool is an example of the special attention being paid to visually impaired consumers. The microwave unit features a braille overlay to enable braille readers to "read" the control panel so they may operate the microwave. Use and care manuals and cookbooks, all in braille, were provided with the microwave, along with an audio cassette which tells about the features of the microwave and how to use them.

Again, it is increasingly apparent that industry must respond to new markets. According to Godwin (1988), as new medical technology gives the disabled more mobility and more patients leave institutions for family settings, the need for homes that can accommodate disabilities ranging from arthritis to quadriplegia has mushroomed" (p. 101).

Safety devices. Safety, in terms of protection from fire is concerned with two factors: control of ignition sources (fabrics, upholstery, etc.) and use of early-warning systems (Raschko, 1982). Both of these factors were considered in the planning of the Laboratory; however, this section will discuss the early-warning systems that have been installed.

- A Gentex 710CS single station 120 VAC photoelectric smoke detector with visual signaling appliance is installed in each room except baths The 710CS is designed to give reliable early warning of the presence of smoke where both audible and visual alarms are required. The 710CS features a 90 db solid state piezo signal and a strobe with red "FIRE" lettering.
- A Heidico bed vibrator (model H-522) is permanently attached to the frames of the beds. When smoke is detected by the alarm system, the vibrator is activated. The gentle vibration is sufficient to alert a sleeping person who might not be able to see or hear audio and visual signals.
- An alternative to a standard smoke detector, a heat detector was installed in the bathrooms in the Laboratory. Since the possibility exists that steam might be interpreted as smoke, a heat detector reports the occurrence of excessive heat. When the temperature reaches 130 degrees, a signal is activated.

- Other safety features demonstrated in the Laboratory include anti-scald controls in the showers, structural scald guards which prevent a paralyzed person from being burned by hot pipes under the bathroom vanities, easy to operate fire extinguishers, hand operated fire alarms and sophisticated telecommunications and environmental control systems.

Other furnishings and equipment. Throughout the Laboratory, an effort has been made to display and demonstrate the latest that technology contributes to the quality of life for persons with disabilities. More than 200 selections offer a wide variety of possibilities ranging from the very sophisticated robot to the very commonplace jar opener. The needs of people are unique; no single environment can be made to successfully relate to each of us. First and foremost, the Bartlett Independent Living Laboratory exists as an example of unlimited possibilities. Equipment there today may be obsolete tomorrow. A goal of the program is to spawn new ideas and to continue to showcase the best that technology can provide.

Current Uses of Technology

During the fourteen months since the Bartlett Independent Living Laboratory opened in October, 1988, there has been a steady stream of students, clients, prospective donors, counselors, therapists, designers, tradespeople, researchers and others using the Laboratory for various purposes. By December 1, 1988, more than 2,300 had,"toured" the facility. In the remainder of this section, the use of the Laboratory for the research, instruction and public service mission of the College/University will be discussed.

A "hands on" learning laboratory. Students from various Colleges in the University have used the Laboratory to meet course objectives. While most of the students who use the Lab are associated with preprofessional courses in housing, interior design, architechture, occupational therapy, community services, construction technology, consumer studies, landscaping, special education, computer science, electrical engineering and mechanical engineering; others have come to the Lab to obtain information for courses in debate, journalism and creative writing.

The Laboratory has been utilized as a planned field trip experience for high school students, youth organizations and gifted and talented students from area elementary schools. Students from other universities in the state have also explored the Laboratory's resources.

All visitors to the Laboratory are challenged to think of themselves as disabled in some way and to examine the Lab's features from that perspective. Visitors are also allowed to operate the technology from a wheelchair. In addition, all visitors are asked to make comments and suggestions and, especially, to answer the question, "What else can we imagine that would be helpful to persons with disabilities?"

A laboratory for research. Due to the newness of the Laboratory and the lack of external support for research, the research component of the program is not well developed at this time. During the first year of the project, efforts have been directed to the development of resource materials deemed helpful to researchers. Materials are categorized in three ways: (a) areas of technology, (b) types of disabilities that make independent living a challenge and (c) services available to individuals and families with disabilities.

In its present stage of development, the Laboratory provides an opportunity to evaluate user satisfaction with technological applications for persons with disabilities, test new designs, conduct and evaluate professional development programs, examine the utilization of community services, study intra-family dynamics in families with disabilities and assess the extent to which persons with disabilities feel empowered.

Data being collected currently include confidential client information and follow-up information on the quality of service provided to those who seek assistance from the Laboratory.

The College of Home Economics is involved in an intensive long range planning process. An expected outcome of the strategic planning is a well defined research agenda relating to Quality of Life for Persons with Disabilities. Preliminary plans for the future will be discussed later in this paper.

A public service program. Public service is defined as the extension of the research, teaching and professional expertise of the faculty of the University for the benefit of the community and the larger society. The Bartlett Independent Living Laboratory has become the nexus of a multifaceted public service program relating to the quality of life concerns of individuals and families with disabilities. The public service offerings include the following components: (a) direct service to clients, (b) technical assistance, (c) networking services, and (d) advocacy for persons with disabilities.

As examples of "direct service", faculty have assisted families in planning adaptations for their homes, locating sources of products needed, making connections with services, and locating others who might offer understanding and support. The Laboratory has also been used as a short-term residence for OSU students who wanted to experience and evaluate the structural accommodations and technological applications available in the Lab.

Goals for the Future

In 1985, the Ford Foundation established a Project on Social Welfare and the American Future (The Common Good, 1989). The 11 member executive panel found "that although the social welfare system was essentially well-conceived, many aspects are now outdated or insufficient to meet the challenges and needs of millions of Americans" (p.2). Faculty involved in the Quality of Life for Persons with Disabilities priority area in the College of Home

Economics at OSU are working to "close the gap" for one target group. In the United States today, it is estimated that 37 million people have some type of disability that affects their quality of life. The OSU project is dedicated to the possibility of improving circumstances for this group by specifically addressing their access and ability to function in their immediate environment, the workplace, the marketplace, and the community at large. General goals for working in this area are indicated in the following paragraphs.

Research

A top priority of the College is to more fully develop the research component of our Quality of Life for Persons with Disabilities program. With the reallocation of existing resources and the acquisition of new funding, faculty will be able to build on current research with new initiatives in the following areas: (a) application of universal design principles (barrier free for all) in residential and commercial settings; (b) standards for independent living technology; (c) functionally designed clothing for persons with disabilities; (d) ergonomics of home-based and industry-based work stations for persons with disabilities; (e) evaluation of user satisfaction with technological applications designed for persons with disabilities; (f) interpersonal dimensions of living with disabilities; (g) coordination of community services oriented toward persons with disabilities; and (h) success of clients trained and placed in the hospitality industry.

Enhancement for the Public/Private Partnership

If the programmatic emphasis on Quality of Life for Persons with Disabilities is to remain viable, the active involvement of the private sector must be more fully developed and maintained. As a nation, we are on the threshold of a new movement centered in a growing commitment to apply our technological savvy in the improvement of personal well-being. As the nation deemphasizes military applications, there is an emerging emphasis on technology for health, daily living, and personal development. Making the private sector aware that their goals and the goals of the academic program can be mutually supportive will be a high priority. A Technological Innovations Fund is planned to assure the constant inflow of dollars to keep our Laboratory on the cutting edge. Specific industries, corporations, and foundations have also been targeted for technology demonstrations, endowed professorships, research projects, study grants, and other forms of faculty support. The University wishes to join its colleagues in the private sector in the overall effort to improve the Oklahoma economy. Technological innovations which will help persons with disabilities become more self-sufficient have the potential of strengthening the state's economy.

Program Interfaces

Another goal for the future is to expand the interfaces with other disciplines, universities, state and private agencies and professional groups. The problems of any group in

our society require the collaborative efforts of several disciplines and special interests if their problems are to be effectively addressed.

Program Evaluation

Evaluation of the public service program on Quality of Life for Persons with Disabilities utilizes an objectives-oriented model (Austin, 1982). Specific techniques for assessing the contribution of public service components to the overall goal structure have been adapted from Drezner and McCurdy (1979). Evaluation inputs are sought from clients, visitors, donors, faculty and others on a continuing basis. Specific plans for evaluating the instructional and research dimensions of the program are not yet complete.

Lifchez (1987) has contributed a stimulating book entitled, *Rethinking Architecture: Design Students and Physically Disabled People*. In a final conclusion in his book, Lifchez stated:

> Good courses and good teachers are important, but more important are good professional schools, schools whose curriculums and policies embody a coherent set of values that speak not only to their students but to society at large. By proposing a vision toward which society should strive, professional schools, like other social institutions, can exert an intellectual and ethical influence beyond their own perimeters. (p. 186)

Lifchez offers a valid criterion against which the program discussed in this paper may be evaluated.

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Trends of Telecommunication for Deaf People

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Introduction

Telecommunications? Deaf People? What makes the connection of telecommunications and deaf people unique?

Sound is invisible.

Deaf people and their eyes

Deaf people rely on printed words or text

Speech-impaired people

Yesterday

Robert Weitbrecht, inventor of the TTY coupler, Phonetype - 1964

Applied Communication Company - 1967

Phone TTY - Essco - 1970

Competition

-prices

-quality

-marketing

AT&T's distribution of TTYs - 1968

Creation of TDI - 1968

-compilation of TTYs

-recruitment

-training

-reconditioning

-distribution

-network (directory)

20 TDD manufacturers

Today

Baudot vs ASCII

Features

-speed

-popularity (E mail)

-availability

- 4 TDD manufacturers
  - Dual switch
  - State TDD distribution programs
  - Portability
- 5 modem manufacturers
  - Internal vs external
  - 300 baud
  - User friendly
  - Compatability
- Local directories
  - Upkeep
  - Regular distribution
  - Volunteerism
  - Donations
- AT&T break-up - 1984
  - Restrictions
    - -equipment
    - -information (text to voice)
    - -interlata system
  - Interexchange systems
- Related services
  - TDD Relay/Dual Party services
    - -legislation (ADA vs state)
    - -PUC (state and FCC)
    - -federal relay services
    - -Judge Greene
      - interlata for relay services
        - encourage more competition
          - prices
          - quality
          - upgrade
        - information interpretation
  - Emergency centers
    - -survey
    - -911 system
    - -legislation

-coordination of equipment and standards

TDD logo

Telecaptioning

-decoders

-chip

-captioning services

Tomorrow

Education

Inclusion of TDD/TTYs as instruction tools

Reduction of restrictions

Expansion of information services

Access to information

Increase 911 safety features

Expand captioned TV programs

TDD installations in studios

Promote decoder chips

Visual alerting systems

Standardization of lumens (research)

Development of specifications (locations)

Legislation

Signage

TDD logo specifications/standards

ASCII

Equipment

Bulletin board systems (BBS)

Access to information

E-mail (time/cost effective)

Closing

With telecommunications available to the eye for reading and fingers for typing, hearing and speech impaired people will appreciate equal access to the world of information effectively.

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